# TRANSACTIONS

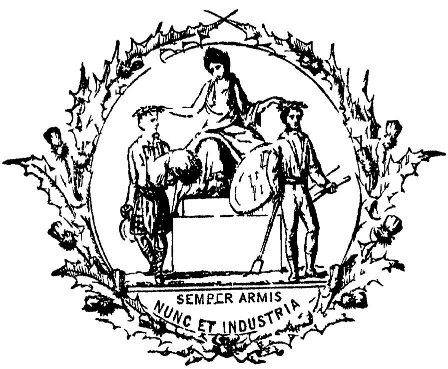
OF

# THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

WITH

AN ABSTRACT OF THE PROCEEDINGS AT BOARD AND GENERAL MEETINGS AND THE PREMIUMS OFFERED BY THE SOCIETY IN 1905

PUBLISHED ANNUALLY




FIFTH SERIES

VOL XVII

EDITED BY JAMES MACDONALD, F.R.S.E., SECRETARY TO THE SOCIETY

EDINBURGH:
WILLIAM BLACKWOOD & SONS, 45 GEORGE STREET
AND 37 PATERNOSTER ROW, LONDON
1905

# WORKS ON AGRICULTURE, &c.

**JOURNAL OF AGRICULTURE, AND TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.**

Second Series, 1828 to 1843, 21 vols —*out of print.*
Third Series, 1843 to 1865, 22 vols.—*out of print.*

**INDEX TO THE FIRST, SECOND, AND THIRD SERIES OF THE TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND FROM 1799 TO 1865.** Cloth, 5s.

**TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND** Fourth Series, 1866 71, 6 numbers, sewed, 4s. each, 1872-88, 17 volumes, cloth, 5s each

**INDEX TO THE FOURTH SERIES OF THE SOCIETY'S TRANSACTIONS FROM 1866 TO 1888,** bound in cloth, 3s.

**TRANSACTIONS OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND** Fifth Series, 1889 1905, 17 volumes, bound cloth, 5s each

**INDEX TO THE FIFTH SERIES OF THE SOCIETY'S TRANSACTIONS**

From 1889 to 1895, paper cover, 1s.
From 1896 to 1902, paper cover, 1s

**REPORT ON THE PRESENT STATE OF THE AGRICULTURE OF SCOTLAND, ARRANGED UNDER THE AUSPICES OF THE HIGHLAND AND AGRICULTURAL SOCIETY** Presented at the International Agricultural Congress at Paris in June 1878 Cloth, 5s. *Free to Members on application to the Secretary*

**DICTIONARIUM SCOTO - CELTICUM A DICTIONARY OF THE GAELIC LANGUAGE,** in two volumes Compiled and published under the direction of the Highland Society of Scotland, 1828. Bound in cloth, £7, 7s; 6 copies on extra paper, £10, 10s.

**PRACTICAL REMARKS ON AGRICULTURAL DRAINAGE.** By WILLIAM W HOZIER of Tannochside Prize Report, published under the auspices of the Society, 1870 Cloth, 1s.

**HUMANITY TO ANIMALS, BEING EXTRACTS FROM PRIZE ESSAYS ON THE MOST EFFECTUAL METHOD OF INCULCATING THAT DUTY IN ELEMENTARY SCHOOLS.** Published under the auspices of the Society Sewed, 3d

**HISTORY OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND, WITH NOTICES OF ANTERIOR SOCIETIES FOR THE PROMOTION OF AGRICULTURE IN SCOTLAND.** By ALEXANDER RAMSAY, LL.D Demy 8vo, cloth, 16s

**THE PINE BEETLE (HYLESINUS PINIPERDA L.).** By W. SOMERVILLE, D.Œc., B.Sc. Prize Report. Sewed, 3d

---

# CONTENTS

## APPENDIX.



**** It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the Writers whose Papers are published in the 'Transactions.'*

# ILLUSTRATIONS

# TRANSACTIONS

OF

# THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

## EXPERIMENTS WITH "GLUTEN FEED."

By JAMES HENDRICK, B.Sc., F.I.C., Consulting Chemist to the Society.

THE experiments described in this paper were intended to test the value of "gluten feed," a by-product obtained in the manufacture of glucose-sugar from the starch of maize, in comparison with such foods as are commonly used for stock in the North-east of Scotland. A large supply of the "buffalo gluten feed" was obtained through the kindness of Mr A. W. Maconachie, M.P., who received it direct from the manufacturers, and who, in view of the fact that this and similar by-products from maize are being introduced from America to the European markets, wished its value fully tested in comparison with concentrated foods which are more familiar to farmers in this country. Numerous experiments have been made with similar maize by-products in America, and they are said to have yielded very satisfactory results.

A number of experiments were arranged with the help of farmers in the North-eastern district of Scotland. The experiments were mainly upon commercial fattening cattle, as the fattening of cattle is the most important agricultural industry in this district, but some experiments were also carried out upon dairy cows, upon breeding cattle, and upon pigs.

## FATTENING EXPERIMENTS WITH CATTLE. FARM OF YONDERTON, CRUDEN, ABERDEEN.

The principal experiment of the series was a fattening experiment on cattle, carried out at the farm of Yonderton, belonging to John Bruce, Esq. of Yonderton, to whom I am much indebted for his assistance, and for the care and trouble he took in personally looking after the experiment, and ensuring accuracy in details. Mr Bruce was ably seconded by his grieve, Mr A. Simpson, who took the greatest interest in the experiment, and to whom my acknowledgments are also due.

For the purposes of the experiment Mr Bruce provided 30 cattle. Of these 24 were two-year-old stirks, and 6 were heifers rising two-year-old. The cattle were all bought in shortly before the experiment began, and were of mixed breeding. They were all of a good type of commercial feeding cattle, and were nearly all of local breeding. The cattle were all housed in the same byre for the experiment, under conditions almost exactly equal.

Before the experiment proper began, the cattle were divided into three lots of 10 each—8 stirks and 2 heifers being placed in each lot. The division into lots was made by the grieve, who, from his knowledge of the beasts, and how they had been doing during the few weeks since they were bought in, tried to divide them so as to make the lots as equal as possible in weight, and in every other respect. A new Pooley weighbridge was obtained for the experiment, but as it had not arrived when the cattle were divided out for the preliminary period of feeding, the division was made by the grieve without its aid. The excellence of his judgment was shown when the first weighing was made, and the gross weights of the three lots were found to be almost exactly equal. His knowledge and experience of cattle were very valuable in other respects. He selected all the cattle for the experiment, and while there were of course differences in quality and thriftiness between them, there was not one really stiff ill-feeding beast among them. In making an experiment of this kind, it is quite as important that the different lots of cattle should be equal as to quality and readiness to feed and lay on flesh, as that they should be equal in weight.

### *Preliminary Feeding.*

On December 29 the preliminary period of feeding began. This period was necessary in order to accustom the cattle to the foods with which they were to be fed during the experiment, and to accustom them to their surroundings, and also to enable us to judge whether the animals were likely to take their food

well, and be otherwise suitable for the purposes of the experiment.

All the animals received for their rough fodder turnips and oat-straw, which form the traditional basal ration for feeding cattle in this district. During the preliminary feeding yellow turnips were used, but after the experiment proper began, on January 10, swedes only were used.

### *Plan of Experiment.*

It was agreed that one of the lots of cattle was to be fed during the experiment just as they would have been fed in the ordinary course had there been no experiment. This Lot, No. III., formed the comparison lot with which the other Lots, I. and II., which received gluten feed, were to be compared. The concentrated foods which Mr Bruce intended to use in the ordinary course of feeding were the "special feeding-cake," made by the Aberdeen Lime Company, and bruised home-grown oats. These were accordingly fed to Lot III., mixed together in equal parts. Lot I. received as concentrated food only gluten feed, while Lot II. received as concentrated food half the quantity of gluten feed fed to Lot I., and half the quantity of the mixture of equal parts of special feeding-cake and bruised oats fed to Lot III.

During the preliminary feeding period the feeding was as follows:—

Lot I. Buffalo gluten feed, 3 lb. per beast per day, with turnips and straw.

Lot II. Buffalo gluten feed, 1½ lb., mixture of equal parts of special feeding-cake and bruised oats, 1½ lb., with turnips and straw.

Lot III. Mixture of equal parts of special feeding-cake and bruised oats, 3 lb., with turnips and straw.

The time-table of feeding all through the experiment was as follows:—

| | |
|---|---|
| 6 A.M. . . . . | turnips. |
| 10 A.M. . . . . | turnips. |
| 3.30 P.M. . . . . | turnips. |
| 8 P.M. . . . . | concentrated foods. |

Straw was always kept before the beasts. It was supplied at every feeding-time.

### *The Foods Used.*

The turnips were not weighed, but were given by measure. The quantity fed in every case was what was customarily fed in the ordinary feeding of the farm. The quantity held by the measure used was weighed, and averaged 31 lb. in weight.

Each beast, therefore, in all three lots, received on the average 31 lb. of turnips three times a-day, or 93 lb. a-day. This was continued right through the experiment. It was not found possible to keep any accurate record of the amount of straw eaten. The cattleman was, however, asked to note, so far as he could, whether the three lots differed at all in the quantities of straw eaten. So far as he could judge there was no difference between them.

The gluten feed for Lots I. and II. was weighed out, mixed with chaff and moistened with water, and allowed to soak for about twenty-four hours before being fed. At first a few of the animals did not take this unfamiliar food readily, but so soon as they became accustomed to it they all took it greedily, and all through the experiment; even at the end, when Lot I. were receiving 6 lb. per beast per day, the feeding-troughs were licked out quite clean before morning.

The gluten feed was sampled and analysed before it was sent out to the farm. The samples were taken from the bulk which was used in all the experiments recorded in this report. Of the other foods a sufficient supply was laid in to last for the experiment, and samples representing the bulk were taken for analysis.

The swedes were all of one variety, and were all grown in the same field. The oat-straw was all from the same bulk, and was considered to be of good quality.

The analyses of all the samples are given in Table I.

TABLE I

COMPOSITION OF FOODS USED IN YONDERTON EXPERIMENT.

| | Buffalo gluten feed No. 1 | Buffalo gluten feed No. 2 | Special feeding cake | Bruised oats | Swedish turnips | Oat-straw |
|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | Per cent | Per cent | Per cent |
| Moisture | 9·05 | 9·77 | 12 61 | 16·32 | 88·06 | 11 28 |
| Oil | 2 74 | 2·83 | 8·94 | 6·60 | | 2·00 |
| *Nitrogenous substances (albuminoids, &c.) | 26 76 | 26·13 | 24 44 | 9 50 | 1·197 | 2·87 |
| †Soluble carbohydrates (starch, sugar, mucilage, &c.) | 52 01 | 51 93 | 39 80 | 49·63 | 9·095 | 40·42 |
| Crude fibre | 7·35 | 6 75 | 8·11 | 15·73 | 0·925 | 39·43 |
| ‡Ash | 2 06 | 2·59 | 6 10 | 2·22 | 0·723 | 4·00 |
| | 100 00 | 100·00 | 100 00 | 100 00 | 100·00 | 100·00 |
| *Containing albuminoids | | | | | 0·750 | |
| † " sugar | | | | | 6 938 | |
| ‡ " siliceous matter | 0 49 | 0·36 | 1 39 | 0 46 | 0·074 | 0·67 |

As the above analyses show, the gluten feed was a little richer in albuminoids than the feeding-cake used, but was much poorer in oil. In this district feeders attach a very high value to oil in cakes and other concentrated feeding-stuffs used for fattening. The oil is valued much more highly, generally speaking, than the same quanity of albuminoids in the food.

The special feeding-cake was a fair representative of a class of cakes very widely used. These cakes are made from a mixture of oil-seeds and cereal by-products, flavoured and made appetising by suitable materials, such as treacle, fenugreek, &c.

The oats were high in fibre and low in albuminoids. At the same time they were rich in oil. This was characteristic of much of the oats grown in the cold, damp, sunless season of 1902.

The analysis shows the swedish turnips to have been of good quality, with a better than average percentage of dry matter. The percentage of sugar is also good.

The oat-straw is not shown by the analysis to have been of very high quality. The albuminoids are low, and the ratio of crude fibre to soluble carbohydrates is high. Straw was a very heavy crop in this district in 1902; but, like the oats themselves, it appears to have been poor in nitrogen. Practical men, judging by appearance, considered this straw to be of good quality, but analysis does not confirm this view.

## *First Period.*

On January 10 the first weighing of the cattle took place, and on the same day the quantity of concentrated food fed to each beast was increased to 4 lb. So that, from this date, each animal received per day in Lot I., gluten feed, 4 lb.; in Lot II., gluten feed, 2 lb., and mixture of cake and corn, 2 lb.; and in Lot III., mixture of cake and corn, 4 lb. This feeding was continued till February 10, when the second weighing took place. In Table II. (p. 6) the weights at these two weighings and the gains in weight made during the month are given. Each animal had his number clipped distinctly in the hair on his rump, so that there was no possibility of them becoming mixed during weighing. Each lot was taken separately from the byre, and driven into a pen, from which they were passed one by one over the weighbridge.

During the first month of the experiment all the animals in the lots took their food well, and continued in good health. Not one of them was ever noticed to go off its food, even for a day, or to go out of condition in any way. Before the end of the month practical men, judging by the eye, were able to tell that Lot I. was making the most rapid progress.

# TABLE II.

## Result of First Period of Feeding.

**LOT I.**

| No. | Weight on Jan. 10 | Weight on Feb 10 | Gain in weight, 31 days |
|---|---|---|---|
| | cwt qr lb | cwt qr. lb | cwt. qr lb |
| 1 (heifer) | 7 1 20 | 8 0 8 | 0 2 16 |
| 2 (heifer). | 7 1 20 | 8 1 6 | 0 3 14 |
| 3. | 8 2 10 | 9 2 0 | 0 3 18 |
| 4. | 8 3 0 | 9 2 0 | 0 3 0 |
| 5. | 9 2 16 | 10 2 0 | 0 3 12 |
| 6. | 10 0 24 | 11 0 0 | 0 3 4 |
| 7. | 10 1 18 | 11 0 20 | 0 3 2 |
| 8. | 9 3 24 | 10 2 0 | 0 2 4 |
| 9. | 9 2 4 | 10 2 11 | 1 0 7 |
| 10. | 9 1 24 | 10 1 11 | 0 3 15 |
| Total | 91 1 20 | 99 2 0 | 8 0 8 |
| Average | 9 0 16 | 9 3 22 | 0 3 6·5 |

Average gain per head per day, 2·92 lb.

**LOT II.**

| No. | Weight on Jan 10 | Weight on Feb 10 | Gain in weight, 31 days, |
|---|---|---|---|
| | cwt qr lb. | cwt. qr lb | cwt. qr lb |
| 11 | 9 1 16 | 10 0 0 | 0 2 12 |
| 12. | 9 3 3 | 10 3 22 | 1 0 19 |
| 13. | 9 1 10 | 10 0 11 | 0 3 1 |
| 14. | 9 3 20 | 10 3 0 | 0 3 8 |
| 15. | 9 1 8 | 10 0 2 | 0 2 22 |
| 16. | 9 3 4 | 10 3 10 | 1 0 6 |
| 17. | 8 3 0 | 9 2 0 | 0 3 0 |
| 18. | 8 3 0 | 9 2 0 | 0 3 0 |
| 19 (heifer). | 7 3 18 | 8 1 4 | 0 1 14 |
| 20 (heifer). | 7 3 12 | 8 1 12 | 0 2 0 |
| Total | 90 3 7 | 98 1 5 | 7 1 26 |
| Average | 9 0 9 | 9 3 9 | 0 2 27·75 |

Average gain per head per day, 2 7 lb.

**LOT III.**

| No. | Weight on Jan 10. | Weight on Feb. 10. | Gain in weight, 31 days. |
|---|---|---|---|
| | cwt qr. lb. | cwt. qr. lb. | cwt. qr. lb |
| 21. | 10 1 3 | 10 3 24 | 0 2 21 |
| 22. | 9 2 0 | 9 3 24 | 0 1 24 |
| 23. | 9 1 20 | 10 0 8 | 0 2 16 |
| 24. | 9 1 8 | 10 0 20 | 0 3 12 |
| 25. | 8 3 20 | 9 1 16 | 0 1 24 |
| 26. | 9 0 20 | 9 2 12 | 0 1 20 |
| 27. | 9 0 20 | 9 3 22 | 0 3 2 |
| 28. | 9 0 0 | 10 0 0 | 1 0 0 |
| 29 (heifer). | 7 1·20 | 7 3 24 | 0 2 4 |
| 30 (heifer). | 8 1 2 | 9 1 0 | 0 3 26 |
| Total | 90 2 1 | 97 1 10 | 6 3 9 |
| Average | 9 0 6 | 9 2 26 | 0 2 20·5 |

Average gain per head per day, 2·47 lb.

### *Second Period.*

On February 10 the concentrated food of each lot was raised to 5 lb. per head per day. It continued at this figure till March 10, when the third weighing took place.

In Table III. (p. 8) the weights at the third weighing, and the increases between the second and third weighings, are given.

It will be noticed that, though the supply of concentrated food was increased to 5 lb. during the second month of the experiment, the animals did not make such rapid progress as during the first month. They all continued in good health, however, and none of them lost appetite at all. All the food given was eaten up, and the troughs well licked out. By the end of this month some of the animals were getting quite fat, and were nearly ready to go to the butcher.

Lot I. continued to maintain its lead, not merely in increase of weight as shown on the weighbridge, but in appearance The animals in this lot were considered by practical men to have particularly good skins, and to be in every respect the most thriving lot.

### *Third Period.*

After the third weighing, March 10, the allowance of concentrated food was again increased. It was now raised to 6 lb. per beast per day in each lot. At this figure it remained till the final weighing took place on April 10.

Table IV. (p. 9) gives the weights at the final weighing, and the increases between the third and final weighings.

By the end of this period a considerable number of the animals, especially in Lot I., were fully fat. This explains why there is such a great decrease in the average gains in weight made during this period, as compared with the second period. One animal, No. 16, Lot II., decreased instead of increasing. He went out of condition a little a few days before the final weighing, and did not take his food well for two days. He did not appear to be in any way seriously ill, but merely to have lost his appetite. He was one of the animals which was already fully fat. After being out of condition for two days he recovered his appetite, and began to increase again, as shown when his weight was taken on April 17, before he was sent to be slaughtered. Had this beast made the average increase, Lot II. would have been ahead of Lot I. during this period. With the exception of No. 16, all the animals kept in good health during the third period, and ate up all their food with good appetite. Lot I. continued to have the best appearance.

In order that the weights recorded at the four weighings should be as strictly as possible comparable, the cattle were

# TABLE III.

## Result of Second Period of Feeding

| LOT I | | | | | | | LOT II | | | | | | | LOT III | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Weight on March 10 | | | Gain in weight, 28 days | | | No | Weight on March 10 | | | Gain in weight, 28 days | | | No | Weight on March 10 | | | Gain in weight, 28 days | | |
| | cwt | qr | lb | cwt | qr | lb | | cwt | qr | lb | cwt | qr | lb | | cwt | qr | lb | cwt. | qr. | lb |
| 1. | 8 | 2 | 12 | 0 | 2 | 4 | 11. | 10 | 1 | 12 | 0 | 1 | 12 | 21. | 11 | 2 | 0 | 0 | 2 | 4 |
| 2. | 8 | 3 | 22 | 0 | 2 | 16 | 12 | 11 | 2 | 0 | 0 | 2 | 6 | 22. | 10 | 2 | 6 | 0 | 2 | 10 |
| 3 | 10 | 0 | 8 | 0 | 2 | 8 | 13 | 10 | 2 | 10 | 0 | 1 | 27 | 23. | 10 | 1 | 4 | 0 | 0 | 24 |
| 4. | 10 | 0 | 6 | 0 | 2 | 6 | 14 | 10 | 3 | 8 | 0 | 0 | 8 | 24. | 10 | 3 | 0 | 0 | 2 | 8 |
| 5. | 11 | 1 | 8 | 0 | 3 | 8 | 15 | 10 | 1 | 8 | 0 | 1 | 6 | 25. | 9 | 3 | 0 | 0 | 1 | 12 |
| 6. | 11 | 2 | 12 | 0 | 2 | 12 | 16 | 11 | 1 | 4 | 0 | 1 | 22 | 26. | 9 | 3 | 16 | 0 | 1 | 4 |
| 7. | 11 | 3 | 14 | 0 | 2 | 22 | 17 | 10 | 0 | 20 | 0 | 2 | 20 | 27. | 10 | 1 | 16 | 0 | 1 | 22 |
| 8. | 10 | 3 | 6 | 0 | 1 | 6 | 18 | 10 | 0 | 10 | 0 | 2 | 10 | 28 | 10 | 1 | 24 | 0 | 1 | 24 |
| 9 | 11 | 0 | 8 | 0 | 1 | 25 | 19 | 8 | 3 | 18 | 0 | 2 | 14 | 29 | 8 | 2 | 2 | 0 | 2 | 6 |
| 10 | 11 | 0 | 12 | 0 | 3 | 1 | 20 | 8 | 3 | 24 | 0 | 2 | 12 | 30 | 9 | 2 | 24 | 0 | 1 | 24 |
| Total | 105 | 1 | 24 | 5 | 3 | 24 | Total | 103 | 0 | 2 | 4 | 2 | 25 | Total | 101 | 3 | 8 | 4 | 1 | 26 |
| Average | 10 | 2 | 5 | 0 | 2 | 11 | Average | 10 | 1 | 6 | 0 | 1 | 25 | Average | 10 | 0 | 20 | 0 | 1 | 22 |
| Average gain per head per day, 2·39 lb. | | | | | | | Average gain per head per day, 1·89 lb. | | | | | | | Average gain per head per day, 1·80 lb. | | | | | | |

## TABLE IV.

### Result of Third Period of Feeding.

| LOT I | | | | | | | LOT II | | | | | | | LOT III | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Weight on April 10 | | | Gain in weight, 31 days | | | No | Weight on April 10 | | | Gain in weight 31 days | | | No | Weight on April 10 | | | Gain in weight, 31 days | | |
| | cwt | qr | lb | cwt | qr | lb | | cwt | qr | lb | cwt | qr | lb | | cwt | qr | lb | cwt | qr | lb |
| 1. | 9 | 0 | 24 | 0 | 2 | 12 | 11 | 10 | 3 | 0 | 0 | 1 | 16 | 21. | 11 | 3 | 20 | 0 | 1 | 20 |
| 2 | 9 | 1 | 16 | 0 | 1 | 22 | 12 | 12 | 0 | 20 | 0 | 2 | 20 | 22. | 11 | 0 | 0 | 0 | 1 | 22 |
| 3. | 10 | 1 | 14 | 0 | 1 | 6 | 13. | 11 | 0 | 0 | 0 | 1 | 18 | 23. | 10 | 2 | 4 | 0 | 1 | 0 |
| 4. | 10 | 2 | 24 | 0 | 2 | 18 | 14 | 11 | 0 | 2 | 0 | 0 | 22 | 24. | 10 | 3 | 14 | 0 | 0 | 14 |
| 5. | 11 | 2 | 14 | 0 | 1 | 6 | 15 | 10 | 3 | 14 | 0 | 2 | 6 | 25. | 9 | 3 | 18 | 0 | 0 | 18 |
| 6. | 11 | 3 | 12 | 0 | 1 | 0 | 16 | 11 | 0 | 6 | loss 26 lb | | | 26 | 10 | 0 | 14 | 0 | 0 | 26 |
| 7. | 12 | 1 | 10 | 0 | 1 | 24 | 17 | 10 | 2 | 0 | 0 | 1 | 8 | 27 | 10 | 3 | 4 | 0 | 1 | 16 |
| 8 | 11 | 1 | 14 | 0 | 2 | 8 | 18. | 10 | 2 | 24 | 0 | 2 | 14 | 28 | 10 | 3 | 12 | 0 | 1 | 16 |
| 9. | 11 | 1 | 6 | 0 | 0 | 26 | 19 | 9 | 1 | 26 | 0 | 2 | 8 | 29 | 8 | 3 | 4 | 0 | 1 | 2 |
| 10. | 11 | 1 | 16 | 0 | 1 | 4 | 20 | 9 | 1 | 4 | 0 | 1 | 8 | 30. | 10 | 0 | 20 | 0 | 1 | 24 |
| Total | 109 | 2 | 10 | 4 | 0 | 14 | Total | 96 | 3 | 12 | 3 | 3 | 10 | Total | 104 | 3 | 26 | 3 | 0 | 18 |
| Average | 10 | 3 | 23 | 0 | 1 | 18 | Average | 10 | 2 | 21 | 0 | 1 | 15 | Average | 10 | 2 | 0 | 0 | 1 | 7 |
| Average gain per beast per day, 1 49 lb. | | | | | | | Average gain per beast per day, 1 39 lb | | | | | | | Average gain per beast per day, 1·14 lb. | | | | | | |

weighed on each occasion at the same time of day—namely, between 1.30 and 3.30 P.M. This secured, so far as it could be done, that their stomachs were at each weighing in a similar condition in regard to the food that they contained.

In every lot of animals, even when they are of quite similar breeding and uniform in their early treatment, there will be individual differences in tendency to fatten. Still more will there be individual differences in the case of a large number of animals such as we have in this experiment, which are not at all uniform in breed, but which were bought in from various sources. These differences are shown in the preceding tables.

The tables show also, what again we might expect, as it is always found in such cases, that the increase laid on by any individual animal in the different periods is subject to great apparent variation, though the animal has remained in good health and condition, and has maintained his appetite all the time. These differences in increase from month to month are more apparent than real, and are easily explained if we remember the great weight of the daily excretions of cattle. In order to get the true increase in weight of the animal from month to month we would need to weigh it without its digestive and excretionary apparatus. By taking a considerable number of cattle in each lot, as has been done in this case, this and other disturbing factors arising from the individual differences and peculiarities of the animals will, to a considerable extent, be eliminated in the average.

*The whole Experimental Feeding.*

The whole three periods of experimental feeding amounted to 90 days. Table V. (p. 11) gives the weights of the cattle at the beginning and at the end of the whole period, together with the totals and averages.

The average gain per head per day for the whole 30 animals was just over 2 lb. This is a good average increase for so large a number of animals over a period of three months, especially when it is borne in mind that these were not specially bred cattle, but ordinary commercial stores bought in the auction marts. The advantage, however, is distinctly in favour of Lot I., which is over ¼ lb. per head per day ahead of Lot II., and nearly ½ lb. ahead of Lot III. Or putting it in another way, the 10 cattle in Lot I. made 237 lb. more increase in 90 days than the 10 cattle in Lot II., and 413 lb. more increase in the same time than the 10 cattle of Lot III. Lot I. therefore made 13 per cent more increase than Lot II. and nearly 26 per cent more increase than Lot III.

As has been already pointed out, it is impossible to get

## TABLE V.

### Summary of Results for the whole Three Periods of Feeding.

**LOT I.**

| No. | Weight on Jan 10 cwt. | qr. | lb. | Weight on April 10 cwt. | qr | lb. | Gain in weight, 90 days. cwt | qr | lb |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 7 | 1 | 20 | 9 | 0 | 24 | 1 | 3 | 4 |
| 2. | 7 | 1 | 20 | 9 | 1 | 16 | 1 | 3 | 24 |
| 3. | 8 | 2 | 10 | 10 | 1 | 14 | 1 | 3 | 4 |
| 4. | 8 | 3 | 0 | 10 | 2 | 24 | 1 | 3 | 24 |
| 5. | 9 | 2 | 16 | 11 | 2 | 14 | 1 | 3 | 26 |
| 6. | 10 | 0 | 24 | 11 | 3 | 12 | 1 | 2 | 16 |
| 7. | 10 | 1 | 18 | 12 | 1 | 10 | 1 | 3 | 20 |
| 8. | 9 | 3 | 24 | 11 | 1 | 14 | 1 | 1 | 18 |
| 9. | 9 | 2 | 4 | 11 | 1 | 6 | 1 | 3 | 2 |
| 10. | 9 | 1 | 24 | 11 | 1 | 16 | 1 | 3 | 20 |
| Total | 91 | 1 | 20 | 109 | 2 | 10 | 18 | 0 | 18 |
| Average | 9 | 0 | 16 | 10 | 3 | 23 | 1 | 3 | 7 |

Average gain per beast per day for 90 days, 2·26 lb.

**LOT II**

| No. | Weight on Jan 10 cwt | qr | lb | Weight on April 10 cwt | qr. | lb | Gain in weight, 90 days cwt. | qr. | lb |
|---|---|---|---|---|---|---|---|---|---|
| 11. | 9 | 1 | 16 | 10 | 3 | 0 | 1 | 1 | 12 |
| 12. | 9 | 3 | 3 | 12 | 0 | 20 | 2 | 1 | 17 |
| 13. | 9 | 1 | 10 | 11 | 0 | 0 | 1 | 2 | 18 |
| 14 | 9 | 3 | 20 | 11 | 0 | 2 | 1 | 0 | 10 |
| 15 | 9 | 1 | 8 | 10 | 3 | 14 | 1 | 2 | 6 |
| 16 | 9 | 3 | 4 | 11 | 0 | 6 | 1 | 1 | 2 |
| 17. | 8 | 3 | 0 | 10 | 2 | 0 | 1 | 3 | 0 |
| 18. | 8 | 3 | 0 | 10 | 2 | 24 | 1 | 3 | 24 |
| 19. | 7 | 3 | 18 | 9 | 1 | 26 | 1 | 2 | 8 |
| 20. | 7 | 3 | 12 | 9 | 1 | 4 | 1 | 1 | 20 |
| Total | 90 | 3 | 7 | 106 | 3 | 12 | 16 | 0 | 5 |
| Average | 9 | 0 | 9 | 10 | 2 | 21 | 1 | 2 | 12 |

Average gain per beast per day for 90 days, 2·00 lb.

**LOT III.**

| No. | Weight on Jan. 10 cwt | qr. | lb. | Weight on April 10. cwt | qr. | lb. | Gain in weight, 90 days. cwt. | qr. | lb. |
|---|---|---|---|---|---|---|---|---|---|
| 21. | 10 | 1 | 3 | 11 | 3 | 20 | 1 | 2 | 17 |
| 22. | 9 | 2 | 0 | 11 | 0 | 0 | 1 | 2 | 0 |
| 23. | 9 | 1 | 20 | 10 | 2 | 4 | 1 | 0 | 12 |
| 24. | 9 | 1 | 8 | 10 | 3 | 14 | 1 | 2 | 6 |
| 25. | 8 | 3 | 20 | 9 | 3 | 18 | 0 | 3 | 26 |
| 26. | 9 | 0 | 20 | 10 | 0 | 14 | 0 | 3 | 22 |
| 27. | 9 | 0 | 20 | 10 | 3 | 4 | 1 | 2 | 12 |
| 28. | 9 | 0 | 0 | 10 | 3 | 12 | 1 | 3 | 12 |
| 29 | 7 | 1 | 20 | 8 | 3 | 4 | 1 | 1 | 12 |
| 30. | 8 | 1 | 2 | 10 | 0 | 20 | 1 | 3 | 18 |
| Total | 90 | 2 | 1 | 104 | 3 | 26 | 14 | 1 | 25 |
| Average | 9 | 0 | 6 | 10 | 2 | 0 | 1 | 1 | 22 |

Average gain per beast per day for 90 days, 1·80 lb.

absolutely accurate and reliable results from an experiment of this kind. This is owing to the fact that it is impossible to obtain and keep a set of animals absolutely uniform and comparable with one another in every respect. The results are always liable to vitiation owing to unforeseen and unforeseeable differences between the animals, individual differences which cause some to fatten more rapidly than others, even when the food and all the other conditions appear to be quite uniform. Something has been done to eliminate these disturbing factors, as already described, by taking the average of a considerable number of animals. If, however, we assume that, in spite of all the precautions taken, Lot III. were on the average worse feeders than Lot I., the experiment still supplies very strong evidence that Buffalo Gluten Feed is superior as a fattening food for cattle to such a mixture of cake and corn as was used for Lot III., for the margin of difference between these lots is so great that it is very improbable that it could have arisen merely from unequal division of the cattle into lots. This presumption is rendered much stronger by the fact tha Lot II., which received half gluten feed and half cake and corn, comes almost exactly half-way between Lots I. and III. in rapidity of fattening. If, now, we compare together the chemical compositions of the two feeds placed in contrast in this experiment some marked points of contrast will be noticed.

The chemical compositions averaged about as follows:—

| | Gluten Feed. | Mixture of Cake and Oats. |
|---|---|---|
| | Per cent. | Per cent. |
| Moisture | 9·4 | 14 5 |
| Oil | 2·8 | 7.8 |
| Albuminoids | 26·4 | 17·0 |
| Soluble carbohydrates | 52 0 | 44·7 |
| Fibre | 7·1 | 11·9 |
| Ash | 2·3 | 4 2 |

### *Value of Albuminoids and Oil.*

The two most valuable constituents of a feeding-stuff are oil and albuminoids. The mixture of cake and oats has the advantage in one of these, oil, while the gluten feed has the advantage in the other, albuminoids. The constituents next in value are the carbohydrates. In these also the gluten feed has the advantage. The relative values of oil and carbohydrates are about as 2½ to 1. It is more difficult to determine the comparative value of albuminoids, but there is reason for assuming that they have a value about equal to that of oil. Assuming that this is so, the comparative values of foods, which are otherwise of good quality and suitable for feeding purposes, are approximately obtained by multiplying the oil and albuminoids

each by $2\frac{1}{4}$ and adding the sum of these to the carbohydrates. The result is called the number of "food units" contained in the feeding-stuff in question. If we treat the gluten feed and mixture of cake and oats in this way, we find that the gluten feed contains 125 food units, while the mixture contains 106·7 food units. It is thus seen that the gluten feed contains a considerably larger number of food units than the mixture. Probably this supplies one of the reasons for its superior action. It would be unwise, however, to insist much on this method of comparison. There are a great many other factors which enter into the problem, and render it most misleading to compare together different foods merely by the number of food units they contain. For instance, digestibility is left out of account altogether, though it is a factor of prime importance. In this case we have, unfortunately, no reliable data on which to compare the digestibilities of the two feeds.

As already remarked, a very high value is placed by the feeders of the north upon oil in concentrated feeding-stuffs. A certain proportion of oil is supposed to be almost necessary to finish animals properly. Oil is often valued by practical men per cent for per cent much more highly than any other ingredient in a cake or other feeding-stuff. The very high value thus placed upon oil is not justified from theoretical considerations, or as the result of experiment. In this experiment the lot which received least oil not only did best, but in the judgment of practical men looked most "oily." When receiving the average amount of concentrated food 5 lb. per head per day, Lot I. received only 0·14 lb., or about one-seventh of a pound of oil per head per day, in their concentrated food. At the same time, Lot III. received 0·4 lb., or two-fifths of a pound of oil per head per day. In addition to this, each lot received a small quantity of oil, practically equal in the two cases, from the turnips and straw. The glossy oily appearance of the skin does not depend on the amount of oil in the food. It can be brought about artificially by adding a small quantity of certain drugs to the food. But, apart from such artificial production, a glossy skin shows that the animal is in good condition and health, and that its food is agreeing well with it. Neither the fat deposited in the body, nor the oiliness of the skin, depends, as is often supposed, on the supply of oil in the food.

### *The Block Test.*

It was originally intended that this experiment should be completed by subjecting all the animals to the block test. However rapidly animals may fatten, and however well they may look and handle outwardly, if they are wastefully fat when

killed, or are otherwise not of good quality and satisfactory to the butcher as carcasses of beef, the outside appearance will prove a misleading indication of the real value of the foods on which they have been finished. One of the objections suggested by practical men when it was found that Lot I. was doing best, was that gluten feed was one of the foods that merely put an "outside polish" on the beast, which, when it was killed, would not yield so good a carcass as a beast fed on cake and corn.

In order to test whether there was any ground for the opinion that the cattle fed on gluten feed would not kill well, it was proposed to have all the cattle killed in the same slaughter-house, and the different lots compared together in the carcass. On April 17, or one week after the final weighing of the whole of the three lots, the first draft, consisting of the three ripest beasts in each lot, was sent in to the slaughter-house of Mr Ross, Aberdeen, who very kindly gave every facility for completing the experiment in this manner, and also gave us his personal aid in judging the carcasses. Mr Ross has great experience as a butcher and consigner of beef to the London market, and his help was therefore of great value to the experiment. The nine animals were weighed before they left Yonderton, and the cooled weights of the dressed beef from each animal, as well as the weights of tallow and suet yielded by the three from each lot, were taken at the slaughter-house. These weights, together with the increase in live-weight made by the animals in the seven days, April 10 to April 17, and the percentage of the live-weights scaled by the cooled sides of beef, are given in Table VI. (p. 15). The feeding during the week from April 10 to April 17 was the same for each lot as during the third period of the experiment.

Unfortunately these beasts were killed just at a time of great depression in the dead-meat market, and it was found impossible without serious loss to have the other animals killed and marketed as was originally intended.

The comparison of the different lots after death must therefore depend on the nine animals, whose weight is recorded in Table VI. Though this is not so complete and satisfactory a test as if the whole of the cattle had been compared after death, it is, at any rate, sufficient to show that there was no ground for the supposition that Lot I. would not show as well after slaughter as the others. In the proportion borne by the dressed beef to the live-weight, the three lots are practically equal; each killed about 55·4 per cent of the live-weight. It is to be remembered that the live-weights are not fasted live-weights, but live-weights taken at the farm with the animals full of food. Fasted weights would have been considerably lower.

## TABLE VI.

### Result of the Block Test.

| Lot. | Live-weight on April 17 | Increase since April 10. | Dead-weights. Cooled dressed sides | Dead-weights. Percentage of live-weight. | Tallow | Suet |
|---|---|---|---|---|---|---|
| Lot I. | cwt qr lb | cwt. qr lb. | cwt. qr lb. | | cwt qr lb | lb |
| No. 6. | 12 0 12 | 0 1 0 | 6 3 22 | 57 2 | 1 2 25 | 14 |
| " 7. | 12 2 0 | 0 0 18 | 6 3 22 | 55·4 | | |
| " 9. | 11 2 19 | 0 1 12 | 6 1 0 | 53 6 | | |
| Total | 36 1 3 | 0 3 0 | 20 0 16 | Average 55·4 | | |
| Lot II | | | | | | |
| No. 16. | 11 1 6 | 0 1 0 | 6 1 14 | 56·5 | 1 0 23 | 36 |
| 19 (heifer). | 9 2 17 | 0 0 19 | 5 1 0 | 54·4 | | |
| 20 (heifer). | 9 2 0 | 0 0 24 | 5 1 0 | 55 3 | | |
| Total | 30 1 23 | 0 2 15 | 16 3 14 | Average 55·4 | | |
| Lot III. | | | | | | |
| No. 21. | 12 0 0 | 0 0 8 | 7 0 14 | 59 4 | 1 1 4 | 37 |
| " 24. | 11 0 8 | 0 0 22 | 6 0 11 | 55 3 | | |
| 30 (heifer) | 10 1 12 | 0 0 20 | 5 1 14 | 51 9 | | |
| Total | 33 1 20 | 0 1 20 | 18 2 14 | Average 55 5 | | |

In suet and tallow Lot I. is ahead. Not only has this lot the greatest absolute weight of tallow and suet, but it has the greatest relative weight. In Lot I. the tallow and suet are equal to 5·83 per cent of the live-weight, while in Lot II. they are equal to 5·01 per cent, and in Lot III. to 4·83 per cent. So far, therefore, as this indication of quality goes, it is in favour of the animals fed with gluten feed.

Before he was told which lot was which, Mr Ross gave the following judgment on the quality of the carcasses as they hung side by side: "They are nine very good cattle on the whole. There is no fault to find with any of them, except No. 16, which is a little wastefully fat. Lot I., however, is the best lot in every respect. They are even fleshed, a nice weight, and have no waste about them. Lots II. and III. are just about equal."

No. 16, which was held to be the only wasteful animal in the nine, was the animal which went off his food for a couple of days just before the end of the experiment.

## Other Fattening Experiments.

In addition to the Yonderton experiment, four other experiments were made with fattening cattle. In each of these

two lots of cattle were compared together. One lot in each case received gluten feed as part of its concentrated food, while the other lot received a corresponding amount of some other commonly used concentrated food. In all other respects the two lots were fed and treated similarly in each case.

*Experiment at Tochineal.*

The first of these experiments was carried out at Tochineal, Cullen, by Mr George Bruce. In it two lots of 7 beasts each were fed experimentally for 90 days. In comparison with gluten feed was placed a compound decorticated cotton-cake containing oil 10·7 per cent and albuminoids 31·7 per cent. The first lot made an average gain of 2·53 lb. per head per day, and the second lot of 2·69 lb. per head per day, during the whole period. The results are very close, but are in favour of the compound cotton-cake, which was not only richer than the gluten feed in oil but also in albuminoids, and contained a larger number of food units than the gluten feed. A feature of this experiment was that the animals received only 42 lb. of turnips per head per day. This is a much smaller allowance of turnips than is usual in this district. The small allowance was compensated for by a mixture of dried distillery grains, barley-bran, and treacle. It is noteworthy that the beasts fed in this way, though only ordinary commercial feeding cattle, made large average daily gains.

*Experiment at Burnside, Fordyce.*

The next experiment was made on 12 home-bred cattle by Mr Allan, Burnside, Fordyce. One-half of these received 4 lb. gluten feed per head per day, and the other half 4 lb. of crushed oats. The oats were of good quality, over 42 lb. per bushel. During an experiment of 126 days the gluten feed lot made an average daily gain per head of 2·30 lb., and the crushed oats lot of 2·07 lb. The oats were richer than the gluten feed in oil, but poorer in albuminoids, and they contain a smaller number of food units. In this case also, therefore, the food which is richer in albuminoids and which contains the larger number of food units gave the better result.

*Experiment at Gauldwell, Craigellachie.*

The third of these experiments was made on 20 animals, 12 home bred black polled cattle and 8 bought-in cattle, by Mr Alex. Cumming, Gauldwell, Craigellachie. Six of the home-bred cattle and 4 of the bought-in cattle were placed in each

lot. One lot received 4 lb. of gluten feed per head per day, and the other lot 4 lb. of oilcake. The animals were otherwise very liberally fed. The oilcake was a high-class article, composed mainly of linseed, and containing about 26 per cent albuminoids and 10 to 12 per cent oil. The experiment lasted 49 days, and during this time both lots made the same average increase of 2·86 lb. per head per day. The home-bred animals, however, made over 3 lb. per head per day, while the bought-in animals, which were not quite such good cattle, made only about 2·5 lb. per head per day, though all were equally fed. These are excellent results, but illustrate well the superior thriftiness of the better bred cattle. It is curious that in this case, where the amounts of albuminoids in the two rations are equal, the results are equal, although the oilcake contained about four times as much oil as the gluten feed.

### *Experiment at Seggat, Auchterless.*

The last experiment of this series was made on 10 heifers by Mr John Hunter, Seggat, Auchterless. One lot received 3 lb. gluten feed per head per day, and the other lot 2 lb. of a high-class oilcake. The endeavour in this case was to compare equal values and not equal weights of the two foods. The beasts were not all weighed and disposed of at exactly the same time, but were taken in pairs, one from each lot. The average duration of the experiment was 112 days, and the average gain per head per day made by the gluten feed lot was 1·70 lb., and by the oilcake lot 1·85 lb. Here, although a larger amount of gluten feed was used, the result is slightly in favour of the oilcake. The cattle were not so highly fed as in the last experiment, nor were they such good doers. The number was not great enough to give so good an average as in the Craigellachie experiment.

### *Other Experiments.*

A large number of other fattening experiments, under somewhat less accurate conditions, were made. The results of these, generally speaking, confirm the results of the experiments described above.

A careful experiment was made with pigs by Mr James Cruickshank, Braehead, Port Errol, the result of which was to show—

1. That gluten feed used alone is not a suitable food on which to fatten pigs. It tends to make them costive.
2. When mixed with some more open food it is greatly improved, fattens pigs about as well and as rapidly

as barley-meal similarly mixed, and fattens them on rather less food, but does not produce quite so good a carcass of pork.

Some experiments made with dairy cows showed that gluten feed is a useful food for milking cows, but that it did not give quite such good results as an equal weight of decorticated cotton-seed meal similarly fed.

*General Remarks on the Fattening Experiments with Cattle.*

In the above experiments, gluten feed, either alone or mixed with oats, has been put in comparison with (1) bruised oats, (2) composite cake and oats, (3) mixed cotton-cakes, and (4) oilcake. It has therefore been compared with a considerable variety of foods, all of which are largely used in this district, in the fattening of cattle, and none of them has proved distinctly superior to the gluten feed. The mixed cotton-cake, which was somewhat richer in albuminoids than the gluten feed, was slightly in advance of it. But even here the difference was too small to establish any distinct superiority. On the other hand, the gluten feed showed itself distinctly superior to the mixture of composite cake and bruised oats, and to the bruised oats alone, and it proved just about equal to the oilcake. These are striking results, as all these foods, with the exception of oats, are dearer than gluten feed. Oilcake in particular is much dearer. The prices of all of them are of course subject to considerable fluctuation with market conditions, but if gluten feed can be supplied to the British market at or under £6 per ton, it is not likely that oilcake, cotton-cake, or even composite cake will be able to compare with it in cheapness.

So far as butchers' opinions were obtained on the animals, they show that animals fed on gluten feed killed at least as well as those fed on other foods.

The exaggerated value often placed upon oil in concentrated foods for fattening animals receives no support at all from these experiments. Gluten feed is poorer in oil than any of the foods with which it was compared, and very much poorer than most of them; nevertheless, as we have seen above, it proved itself as good as the others as a fattening food. The only one which gave a result at all ahead of it was richer than it in albuminoids as well as in oil.

At the same time, it is well to remember that it has been proved that oil digested by an animal has, weight for weight, a value over twice as great as carbohydrate digested by the animal. The albuminoids stand on quite different ground, and are not strictly comparable with the oil and carbohydrates. In the case, therefore, of a food such as oilcake, which is about

equally rich in albuminoids with gluten feed, and which appears to be more grateful and palatable to stock than the gluten feed, we might expect that the larger amount of oil present would cause it to fatten animals distinctly more rapidly than gluten feed. As it has not done so, the gluten feed must be able to make up in some other way for the disadvantage under which it lies in having only about one quarter of the oil present in oilcake. These experiments do not throw any light on this point. It is probable, however, that a comparative study of the digestibility of the two foods would throw light on this point. We have no digestion experiments made in this country with gluten feed, and know little of its digestibility. If it is more digestible than oilcake its superior digestibility would make up for the superiority of the oilcake in oil. Experiments on this point would be interesting and valuable.

In some cases it was found that the cattle did not take the gluten feed very readily at first; but in every case they became fond of it, and ate it up readily when they got to know it better. It was found advisable to wet it, and let it soak and swell in water for some hours before feeding it. Some of the most experienced feeders recommend mixing it with hay, chaff, or other foods of loose or open texture. This point is also referred to by many of those who tried rough experiments without weighing. In any quantity which was tried in the experiments, it was found that the gluten feed agrees well with cattle, and gives them a good appearance.

In conclusion, I have to thank all those who took part in these experiments. On them the main part of the labour fell, and they, one and all, gave their help ungrudgingly, and even with enthusiasm.

---

# FOREST ENTOMOLOGY.

## MITES, GREEN-FLY, AND SCALE-INSECTS.

By A. T. Gillanders, F.E.S.

In this country, fortunately, we have but comparatively few species of insects so numerically strong as ever to be alarmingly looked upon as direful pests. Consequently it has been customary to study only those species which either annually or periodically arrest attention by reason of the damage done by them to our trees or shrubs. Though apparently this method would solicit limited concentration, often the goal of

success, yet it does not afford a sufficiently broad grasp of the rudiments of Entomology generally, so as to either recognise the many unnoticed damages or to discriminate any species of injurious insects that may suddenly make their appearance.

The following paper is an attempt to convey an impression of the wide scope of "Forest Entomology," and to give a brief account of certain classes of insects not previously dealt with in the 'Transactions' of this Society.

As regards the subject itself, it may appear somewhat paradoxical to say that Forest Entomology differs from the entomology of the forest. Under the latter heading the major portion of the science of entomology may be included, inasmuch as the student of general entomology, or the specialist of any particular group, will often find the forest one of his happiest hunting-grounds. With regard to "Forest Entomology," even in its widest sense we can only embrace directly all insects preferring an arboreal diet, and indirectly all other insects parasitic on arboreal feeding insects.

From a husbandry point of view the science of economic entomology may be divided into three principal divisions—viz., garden pests, farm pests, and forest pests. The last is obviously the most difficult to deal with.

Before any pest can be satisfactorily checked, it is indispensable to study the life-history of the insect—viz., the egg, the larva, the pupa, and the perfect insect—and then deal with that stage in which the most practical results can be obtained.

To carry this out two methods of arrangement suggest themselves—viz., a botanical and an entomological. With regard to the former, it would be necessary to classify the respective trees, and then arrange those insects which feed on them. This method has been adopted by the American writers. It has, however, this drawback—that while several insects are fastidious as to their diet, others (except for the distinctions between hardwoods and conifers) are general feeders. Several German writers follow an entomological method, and this course appears to be far more educational to the student of forest entomology.

As the forest is a field literally teeming with varieties of animal life, it may just be as well in passing to remind the practical husbandman and general naturalist that there are numerous creatures in the forest, under rotten bark and so forth, which are not in scientific language insects. Such creatures are snails, centipedes, spiders, and worms of various genera.

Hence the question arises, What is an insect? In answer to this question, the general definition, with some common exceptions, is that an insect is a creature whose body is divided

into three parts, has two antennæ, six legs, and passes through four stages of metamorphoses.

Accepting this general definition, it may be said that the creatures which in point of anatomical structure and economic injuries approach nearest to insects are mites and spiders. And as a rough-and-ready classification for our purpose, we may say a mite is a creature whose body is made up of one piece, a spider two, and an insect three.

The mites most injurious to vegetation are the Phytopti or four-footed mites. Spiders are not directly injurious to trees, and therefore need not be considered. We find a certain species of "red-spider" (which, scientifically considered, is a mite) injurious to the foliage of ivy and other plants, sucking the juices from the leaves, and causing them to turn a sere colour.

The whole realm of Entomology is divided into seven orders —viz., Coleoptera, or beetles; Orthoptera, or earwigs, crickets, grasshoppers, and locusts; Neuroptera, or dragon-flies; Hymenoptera, or ants, bees, and saw-flies; Lepidoptera, or butterflies and moths; the Hemiptera, including the various species of bugs; and Diptera, or two-winged flies.

The Hemiptera is subdivided into two principal divisions—viz., Hemiptera-Heteroptera, including the bugs; and Hemiptera-Homoptera, including Aphidæ or plant-lice, Cicadæ, Psyllidæ, and Coccidæ or scale-insects.

With the exception of Orthoptera and Neuroptera, all the other orders are included in forest entomology. Hence the necessity of versatility in entomological knowledge will be apparent.

In order to understand the subject a little more fully, let us by way of introduction briefly consider the life-history and structure of a typical insect.

It has just been remarked that, as a rule, insects pass through four stages of metamorphoses—egg, larva, pupa, and perfect insect. When an insect passes through all those stages, the metamorphosis is said to be complete. When, however, it does not—as, for instance, in the case of Aphidæ or plant-lice—the metamorphosis is said to be incomplete.

Let us follow a typical example from a complete metamorphosis, commencing with the egg stage.

The eggs of insects are always deposited in the immediate vicinity of the food for the larvæ. In cases of many arboreal insects the eggs are often very difficult to discover. Sometimes they are concealed within the buds, in the midribs of leaves, the roots, bark, or other convenient places, according to the food of the larvæ. Insects adopt many devices against weather and natural enemies—such as covering them over with a gummy

secretion, the shedding of hairs, the formation of cocoons, and so forth. The eggs of insects possess very strong powers of vitality, as frost generally has very little effect on them. They vary very much in size, form, and markings—some are smooth and spherical, others corrugated, sculptured, elongated, and tailed.

The structure and development, as seen through the microscope, form not only a very interesting study, but present many difficult biological problems. Amongst the higher egg-producing animals no egg will develop without male fertilisation, but amongst insects there are many exceptions to this rule. Amongst saw-flies, certain generations of gall-flies, plant-lice, and others, we have reproduction by virgin females. This law is known as parthenogenesis. The morphological structure of the egg is somewhat complicated, more especially when we remember the philosophical writings of Weismann and others.

The term larva, caterpillar, maggot, or grub is generally applied to insects as they hatch out from the egg, and at this stage they generally differ in form and structure from the perfect insect. On the other hand, the term "nymph" is applied to the creature when it bears a very strong resemblance to the perfect insect.

The larva of a moth, for example, on hatching from the egg is usually a segmented body possessing sixteen legs. The caterpillar of a saw-fly has six true legs, like the larva of a moth, but has also several additional "prolegs," and consequently is easily distinguished. The maggot of a fly is footless. Whatever shape and form they may take, the young insect in the first stage is always scientifically known as a "larva," and we have in forest insects all forms and classes of larvæ, and this variety is of great interest as a biological question. For instance, we find, as arboreal feeding insects, active six-legged larvæ of a greenish colour, and harmonising with the foliage or lichens on the bark; while on the other hand we find the footless whitish grub feeding within the wood. Thus we have two important factors in the theory of evolution brought before us—viz., the absence of legs through disuse, and the harmony of colour to surroundings as a protection against natural enemies.

The pupa, or third stage of the life of an insect, is a period of rest or quiescence, when the insect takes no food. In forest insects the pupal stage is very varied. Some descend into the ground to pupate, others form hard cases on the food-plant.

The stages thus referred to—viz., egg, larva, and pupa—are the periods of growth and development. As soon as bursting from the pupal case takes place, the creature is then literally the perfect insect, inasmuch as no further change or development takes place. It is well to bear this in mind, as it is a popular

notion amongst certain people, not conversant with natural history, that small moths and flies are simply "young ones." Such, however, is not the case, for while individual specimens of the same species often differ in size, there is as a rule general uniformity of size in insects of the same species.

As a biological subject insect anatomy and physiology is a very broad and interesting one, inasmuch as serial section-cutting and the highest powers of the microscope must be enlisted. This, though highly interesting in itself, is certainly not of vital importance to the student of forest insects. It is, however, indispensable that the salient features of head, thorax, and abdomen should in all cases be well studied, and in some special instances be committed to memory. It is upon those points that generic and specific characters depend.

The head is theoretically composed of a number of pieces, but in general appearance is made up of one piece. On the under side it bears the mouth, which is either adapted for biting or sucking. The mouth arrangement splits the whole of the insect kingdom into two principal divisions—viz., Mandibulata, or biting insects; and Haustellata, or sucking insects. The biting mouth of the beetle and the trunk-like proboscis of the moth are cases in point.

The thorax or middle segment is theoretically composed of several pieces, and from this portion the wings and legs arise. It is further considered as being divided into three distinct portions—viz., prothorax, mesothorax, and metathorax. These segments vary in proportionate size according to the orders of insects; and they also vary in size in the respective stages of the life of an individual insect. The thorax and its component parts is of considerable importance in the discrimination of species, as, for instance, in the Hymenoptera.

The third segment is known as the abdomen, and is very variable in form, according to order and genus. It is generally composed of nine segments, and bears the organs of reproduction.

The wings, considered in detail, are very important points in the discrimination of genera and species. In fact, some writers use the wings as a basis of classification. So far as forest entomology is concerned, it is highly essential to make a detailed study of the structure of the wings of saw-flies, gall-flies, Aphidæ, and Diptera.

## Mites (Eriophyinæ).

The Phytopti or gall-mites have of late years received some considerable attention, inasmuch as one species, known in our gardens as the "currant-bud mite," has proved a common pest in many parts of the country. The absence of fruit, together

with the general appearance of the abnormal swollen buds, have been graphically termed "blind bud," and the creature causing this widespread trouble has been long known by the name of *Phytoptus ribis.*

The common garden pest referred to has its equivalent in the forest, producing "blind buds" on several kinds of trees, more especially in the nursery, as well as certain abnormal growths on the leaves or fruit of other arboreal species.

The difference between a diseased and healthy bud is very easily recognised. In the latter the buds are comparatively small and pointed, whereas the former are swollen and rounded.

Within the last few years elaborate researches have been made by Dr Alfred Nalepa of Vienna, and to his writings all interested in economic entomology must refer. About thirty species, arboreal and others, have been found in Britain. He has established various genera, families, and sub-families; but unfortunately he has seen fit to change the generic name *Phytoptus* to *Eriophyes,* and this term has been adopted by Mr E. T. Connold in his most interesting work on 'British Vegetable Galls.' It is of course only right to adopt the name given by the greatest Continental authority, but one feels somewhat reluctant to part company with the old familiar term.

The life-history and microscopical characteristics of Eriophyes form a most interesting study. It belongs to the sub-family Eriophyinæ of the order Acarina. It is of a light-yellowish colour, and varies very much in size according to species. Perhaps the size of the creature may be approximately put down as $\frac{1}{200}$ to $\frac{1}{1000}$ of an inch in length: it is indistinguishable by the naked eye, and can only be seen by a strong pocket lens or the inch-power of the microscope.

The body is of a vermiform shape, and, like mites in general, is made up of one piece. On the upper side of the head is a shield-like plate with peculiar markings. The maxillæ are used as antennæ.

The abdomen is greatly elongated, and has a great number of striæ or markings of ring-like appearance across the body, which vary according to species from 40 to 95.

The legs are four in number, which characteristic has been the subject of much controversy, and, as compared with insects, mites, and spiders, was considered incapable of ordinary locomotion, inasmuch as the typical mite and closely allied spider have eight legs. However, with its four legs and its several pairs of abdominal bristles it can move at a comparatively quick speed. At the extremity of the tarsi there are very fine bristles, called by the Germans "Fiederborste," or feather bristles.

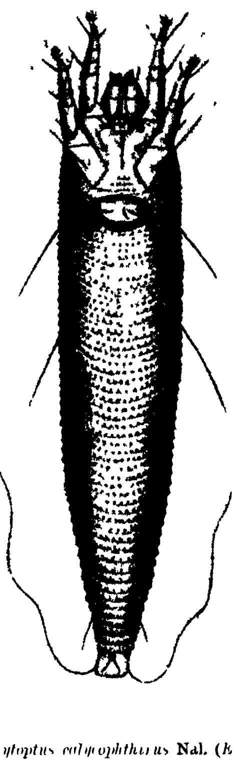
A creature of such simple structure affords but few points

for specific differences, and the salient points for the discrimination of species are the markings of the shield-like plate and the number of striæ or ring-like markings across the body.

Plate I. is, and may be considered as, a typical mite.

From a botanical or practical point of view the Eriophyinæ may be divided into three classes—viz., those feeding within the buds, those living in galls, and those forming malformation of fruit, &c.

PLATE I.



*Phytoptus calycophthirus* Nal. (*Eriophyes ribis* Canest) Photographed from 'Genera und Species der Familie Phytoptida.' Wien, 1891.

*Species living in Buds.*

These may very easily be seen under the microscope eating the vital parts of the bud, which, instead of bursting into flower or leaf, becomes the dwelling-place of many mites.

With regard to the actual number of mites tenanting a single bud, Mr Newstead says of *Phytoptus ribis*: "The number of mites tenanting a single bud would vary according to the time of the year. By desire of Mr Spencer-Pickering I last year (January 9, 1900) selected a medium-sized bud-gall, and in it counted 2748 individuals, allowing for many individuals destroyed in dissecting the bud. I should put the number in round figures at 3000. Larger buds would contain considerably more, and in March it would be safe to add half as many more."

*Eriophyes avellanæ* Nalepa. — The Nut-tree mite is found in filbert and cob-nut plantations. The swollen and deformed buds can easily be recognised before the development of the leaves, and they are also afterwards conspicuous, as shown in the accompanying illustration (Plate II., fig. 1).

The species living in buds more or less lend themselves to periodical examination throughout the whole of the year. Having examined them in February from young hazel plants, I found the enlarged buds, more especially the infested terminal buds, conspicuous as globular balls about half an inch in

diameter. Numerous mites were found in all portions of the bud, from the outer scales to the centre. They were discovered in all stages—viz., eggs, nymphs, and perfect mites. The perfect mite is larger than the species found on the black currant; and the eggs are also larger, and whitish, smooth, and oval-shaped. The nymph is approximately about half or a third the size of the perfect mite, and the four legs lie in a stationary position stretched out in the direction of the mouth.

Our examination of the swollen buds during May, when the leaves were half developed, showed the infested buds to be tenanted with mites in all parts, and a few mites outside the bud, and crawling along the leaf-stalks.

In July another examination was made, and it was discovered that the mites were chiefly in the interior of the swollen buds. There were a few on the leaf-stalk and on the portion of the stem adjacent to the infested buds. At this time the swollen buds were quite half an inch in diameter, and the young buds for the forthcoming season just formed.

In Plate II., fig. 2, two swollen buds on birch are represented. They were cut from the same branch, and in close proximity to a "witch's broom"—the peculiar bird's-nest-like appearance as seen on birch, hornbeam, and other trees.

*Eriophyes psilaspis* Nal. (Plate II., fig. 3) was first discovered by Professor Sir Thiselton Dyer in the spring of 1875 doing immense damage to hedges, which damage had hitherto been attributed to frost. I found it plentiful on the under side of the lower branches of a yew-tree from which the photograph was taken, and I have also found it very plentiful on young yew-trees in the nursery-lines.

### *Species living in Galls.*

There are numerous species living in galls on the leaves of various trees, and the following are a few typical examples. They are not true galls, however, but empty pseudo-galls; and it is interesting to compare the structure of the pseudo-galls of Eriophyinæ with the true galls of gall-forming insects, as for example the galls on the oak. The former is simply an abnormal thickening of the leaf, and always having an opening or passage leading into the pseudo-gall. The opening is always surrounded

---

*Description of Plate II.*

FIG 1.—"Blind-buds" on Hazel caused by *Eriophyes avellanæ* Nal
" 2.—"Blind-buds" on Birch caused by *Eriophyes rudis* Canest.
" 3.—"Blind-buds" on Yew caused by *Eriophyes psilaspis* Nal (*Phytoptus taxi* Murray).
" 4.—Galls on leaf of Lime caused by *Eriophyes tiliæ* (*typicus*) Nal.
" 5.—Galls on leaf of Sycamore caused by *Phyllocoptes acericola* Nal (*Phytoptus aceris* Murray).
" 6.—Galls on leaves of Alder caused by *Eriophyes lævis* Nal.

PLATE II. (For description, see footnote, p. 26.)

by hairs, which doubtless act as a protection against the inroads of acari and other natural enemies. The true gall, on the other hand, is always closed, and the form variable and immaterial. Certain species of leaf-miners (Lepidoptera) form conical galls or cases on the upper side of the leaf; but the passage communicates between the epidermal skins, and has no opening through, as in the gall of Eriophyes.

In Plate II., fig. 4, we have represented what is popularly known as "nail galls" on the lime leaf—on the leaves of *Tilia europæa*. In Murray's 'Economic Entomology' it is named *Phytoptus tiliæ*, but in Connold's 'Vegetable Galls' we do not find this name adopted even as a synonym. In fact it is termed *Eriophyes tiliæ* (*typicus*) Nal.

It is, however, a very interesting species, inasmuch as the "nail galls" were first considered by Réaumur, the celebrated French entomologist, as a special vegetable formation accruing from animal life; but in the absence of any description one is doubtful if he had seen the real tenant, or simply a parasitic lodger. Be this as it may, however, the literature on the subject shows that no one else saw them for certain until one hundred years afterwards.

In Plate II., fig. 5, we have galls on the upper side of the leaves of the sycamore, *Acer pseudo-platanus*, caused by a mite of which Mr Connold gives the following synonyms:—

| | |
|---|---|
| *Phyllocoptes acericola* | Nal. |
| *Volvulifex aceris* | Amer. |
| *Ceratoneon vulgare* | Bremi. |
| *Phytoptus aceris* | Mur. |

The galls very often cover the whole surface of the leaf, and are very much smaller than the galls on the lime-tree leaf.

Such are a few typical specimens of arboreal Phytopti (adhering to the old term) living in buds or forming galls. There are many others, more especially those species living in galls found on trees; but with the exception of two species—viz., those on hazel and yew—they are not very destructive, and certainly not to be compared with the species on black-currant.

From the foregoing remarks it will be seen that the study of those mites is purely a microscopical one. The bases of classification are so minute, and the points of discrimination so difficult to determine, that the question naturally and suggestively arises whether we have the same or different species of mite doing several kinds of injury. As bearing on the specific differences of mites found on different food-plants, I may say that from local examinations I have not found the species on black-currant in Northumberland, whereas the species on hazel is not only quite common, but may often be found asserting

itself alongside gardens with an abundance of black-currant bushes quite immune from the direful pest.

Mr Newstead, Curator of the Grosvenor Museum, Chester, carried out a number of observations with regard to the species on black-currant, and found that there was a succession of broods from February to September. He also discovered that when the infested buds shrivel up and become unable to support the mites they migrate to the leaves and leaf-stalks, and enter the newly formed buds towards the end of July, where they remain until the following summer.

The foregoing observation is interesting, inasmuch as it contrasts slightly with the species found on hazel. The "blind buds" of the hazel do not shrivel up so quickly as those on black-currant. Consequently the swollen buds of hazel may be found teeming with life about the latter end of July, while comparatively few may be seen on the leaves and leaf-stalks. The buds for the coming year are then formed, and the mites could be able to move from one house to the other without camping out during Nature's building operations.

### GREEN-FLY (APHIDÆ).

Considered economically, perhaps no class of insects are more deserving of the appellation "injurious" than the Aphidæ or "green-fly." From an entomological point of view, the ambiguous term "blight" is adopted for the destruction accruing from this class of insects, which are individually small in size, but collectively most injurious.

The body of the aphis is pear-shaped. The head, which is small in comparison with the rest of the body, has two large compound eyes, which vary in colour from ruby red to brown or even pure black.

The beak, which is always an important organ in insect structure, is peculiarly adapted to the destructive demands of the creature, and just shows that all insect anatomy is a modification of similar parts to meet the needs of the creature. It is composed of three joints, which vary in length according to genus and species. Thus in the *Stomaphis*, a species living on oak, the beak is longer than the body, while in the genus Chermes it is very small indeed. In each case the mouth is adapted to the food-plant. The former lives on oak deeply furrowed: the body reposes on the outer hard bark, and the long proboscis is a necessity to reach the bottom of the narrow fissure where the juice can only be found. On the other hand, the short-beaked Chermes lives on smooth bark, on which the slightest tap would yield the necessary juice.

The antennæ are from three- to seven-jointed, and form good

points for classification. They are very variable in length according to genera, and are also variable in the larval stage as compared with perfect insects of the same species. Hence it is essential in the discrimination of genera to know that we are dealing with adults.

The wings are thin and of a beautiful transparent colour, folded ridgewise over the body, but possessing poor powers of flight. The venation of the wings is a very important point in classification. The third vein, counting from the body of the insect, is twice forked in the tribes of Aphidinæ and Lachninæ, once forked in the tribe Schizoneurinæ, and *not* forked in the tribe Chermisinæ. The wings are carried vertically when at rest.

The abdomen is composed of several rings, and is capable of much distension, this being dependent on the amount of food taken. The number of rings or somites is variable. On the sixth segment many genera have two important tubes or appendages called cornicles, for the exudation of a liquid substance known as honey-dew; others have none.

Honey-dew is a substance which has given rise to a good deal of speculation. It is of a saccharine nature, and is consequently sought after by other insects, more especially ants, which not only sip the juices, but extract the honey-dew from the aphis by squeezing it from the cornicles. This phenomenon may be observed on the aphides on elder.

The honey-dew is very injurious to vegetation, for not only does it have a tendency to choke up the stomata or breathing-pores of the leaves, but the injury is still further increased by the honey-dew forming a lodgment for soot, dust, and dirt.

The life-history of an aphis presents many interesting points, either considered biologically or as evidenced by the mysterious appearance or disappearance of the so-called "blight" or "green-fly."

Aphidæ generally appear simultaneously with the green foliage. The first brood of the season originates either from a female which has hibernated during the winter months, or from eggs—that is, generally true eggs, resulting from male fertilisation. In the former case the "stem-mother," as the Germans call her, very much resembles the queen-wasp, inasmuch as she is the mother or founder of a whole summer's colony. As a rule she is considerably larger and less active than any of her offspring.

The brood arising from eggs which had been deposited in autumn, or from the stem-mother in spring, give rise to insects which are generally all females. These may be found in two forms—viz., winged and apterous. In many genera, when but a few days old, both forms are capable of giving birth to living

young. Each individual insect produces from 90 to 100 progeny, and so on until about twenty generations are produced in a single season. Hence it will be seen by a progressive calculation that the numerical strength of the progeny produced by a single insect certainly becomes appalling, and this number is under rather than over the average.

In order to realise the numerical strength of aphis reproduction, Professor Huxley made some wonderful calculations, and has put them together in his own inimitable way. He calculated that if an aphis weighs $\frac{1}{1000}$ of a grain avoirdupois, and a stout man not more than two million grains, about twenty stones, then the tenth brood formed (exclusive of all the preceding broods, supposing that the multiplication had been altogether unchecked by the various causes which generally influence it) will exceed in weight five hundred million men, or about one-third the entire population of the globe. This calculation is made on the assumption that each individual member could turn the scales at 280 lb., and also that each aphis is capable of producing only twenty young, whereas, according to Latreille, the average rate of production of a viviparous aphis during the summer months is twenty-five per day.

Fortunately for vegetation, the aphis has several natural enemies to keep the enormous reproduction within bounds. Heavy rains act as a check, but, entomologically considered, the small *Chalcididæ* (Hymenopterous parasites), which pass their metamorphic stages in the interior of the Aphidæ bodies, are of inestimable value in keeping them down. Throughout the summer months the dead bodies of the Aphidæ may be found adhering to the food-plant. These bodies are mere chitinous shells, with a small hole whence the tiny Hymenopterous parasite has emerged.

At the end of the season the last brood for the year is generally composed of males and females. In certain species males have not been discovered for a few years. But investigation seems to show that sooner or later males will appear, verifying what Andrew Knight said in 1799 regarding self-fertilisation—viz., that it is a "law of nature that organic beings shall not fertilise themselves in perpetuity." Subsequent research has borne out this statement in other animals.

It is well known to every entomologist, collector, or economist that the number of insects depends very considerably on the conditions of the weather and the supply of food. The Aphidæ are certainly more susceptible to those external influences than any other class of insects. Should the weather suddenly become colder, a greater number of winged specimens will appear, as they do also in the event of the food-supply becoming scarce.

It is neither by chance nor latent ability that apparently apterous individuals suddenly become winged, but apterous specimens give birth to young which develop wings. Hence the sudden change from wingless to winged specimens is the result of the short period necessary for the ushering in of a fully developed fresh brood, which will adapt themselves to natural changing conditions.

In other words, the newly born brood will move to new quarters either in search of food or warmth. And here comes in a very common but erroneous notion—viz., that the sudden appearance of "blight" is due to "east winds." Now the fact is that the proverbial east wind has simply assisted the winged aphis, which, after all, is but poorly adapted for locomotion, to move from his native land to "fresh fields and pastures new."

Winged forms are known at an early age as larvæ, the pupal stage being that period when the wings are half grown. Some species pass through those metamorphic stages before their life-cycle is complete. Thus apterous larvæ, semi-winged pupæ, and winged imagines may be constantly found throughout the summer season on the food-plant.

Both apterous and winged females produce living young; but, according to Buckton and other observers, the pupæ never give birth to young.

There are two classes of females apart from apterous and winged—viz., oviparous and viviparous—the first reproducing themselves by eggs, the second by living young. It is asserted by many practical workers that the oviparous never becomes viviparous, or *vice versa*—the same individual aphis never produces eggs and living young.

The difference between producing living young and the deposition of eggs, on the part of the respective female insects, would appear simply a question of time and stage of reproduction; but it affords a subject for actual investigation by dissection and serial section-cutting, in order to ascertain the morphological difference between oviparous and viviparous organs.

## Classification.

Mr Buckton divides the family Aphididæ into five tribes—viz., Aphidinæ, Schizoneurinæ, Pemphiginæ, Chermisinæ, and Rhizobinæ.

The following are the principal tribes and genera, which are arboreal in their habits:—

*Tribe* **Aphidinæ.** — Upper wings with cubital vein twice forked; lower wing with two oblique veins. Antennæ long, with seven joints, 7th joint long, 3rd usually longest.

The following are the principal genera belonging to this tribe, which are arboreal in their habits:—

*Genera*—Myzus.
Drepanosiphum.
Melanoxanthus.
Aphis.
Chaitophorus.
Callipterus.

*Tribe* **Lachninæ** (woolly).—Wings same as in Aphidinæ. Antennæ six joints, 7th rudimentary.

*Genera*—Phyllaphis.
Lachnus.
Stomaphis.
Dryobuis.

*Tribe* **Schizoneurinæ.**—Upper wing, cubital vein once forked; lower wing with two oblique veins. Antennæ six joints, 7th rudimentary, 3rd ringed, 4th often ringed.

*Genus*—Schizoneura.

*Tribe* **Pemphiginæ** (gall-forming).—Upper wing, cubital vein not forked; lower wing with one or two oblique veins. Antennæ short, six joints, 7th rudimentary.

*Genera*—Pemphigus.
Tetraneura.

*Tribe* **Chermisinæ** (*kermes*, a red dye).—The genera of this tribe are varied in their habits, inasmuch as they are scale-like, bark-feeders, gall-makers, or wool-spinners, and sometimes subterranean.

*Genera*—Chermes.
Phylloxera.

*Myzus cerasi* Fab. is very common on wild cherry, or gean of the forest, as well as the cherry of gardens and orchards. The damage done by the insect is very easily recognised. The injured shoots form a sort of rough rosette of leaves (Plate IV., fig. 1), and the absorbing action of the insects, coupled with the exudation of honey-dew, add a sort of sooty appearance to the damaged shoot.

The apterous viviparous female is wholly black in general appearance. Antennæ are not conspicuously long. The abdomen is of a very shiny black colour. The cornicles are rather long. The eyes are a darkish brown colour.

The winged viviparous female is wholly and conspicuously black, with rather long antennæ and broad wings.

*Drepanosiphum platanoides* Schr. is a common aphis which lives on sycamore, and may be found simultaneously with the appearance of the foliage.

The eggs of this species may be found very plentifully on the bark of sycamore during the winter months. They are black in colour, and when abundant their glossy appearance on lichen and *Protococcus viridis* renders them conspicuous to the naked eye at some distance.

The larvæ are found on the young leaves just as the latter are bursting. When hatching they are of a bright green colour, with very long antennæ and conspicuously red eyes. In general appearance the body is so slender that the creature may be said to be all "legs and arms."

The pupal form, or stage between larvæ and winged insect, is very variable in both colour and general appearance.

The winged insects are also variable in colour, but the prevailing hue is bright green. The head is rather flat, the eyes are very prominent, and being of a golden green colour, contrast very strongly with the head and body. The antennæ are black, long, and slender, and consequently liable to injury. There are two vertical black markings, and five or six transverse bars, on the abdomen, as well as similar markings on the under side. The legs are variable in colour. The tail is short and not very conspicuous. The cornicles are comparatively long.

This is altogether a handsome-looking aphis, and is suggestive of a lobster. It may be shaken in showers from the leaves. This species, however, is so very variable in colour that Mr Buckton gives several varieties in both larval and perfect forms.

About the middle of April, just before the winged insects appear, large apterous specimens, very much larger than the general larvæ, and of a mahogany colour, may be found. Contrasting with the larvæ just referred to, it may be observed that, in proportion to the size of the body, the antennæ, cornicles, and tail are all comparatively short. The abdomen is large, warty, and bristly. At first sight this insect may be taken for a "stem-mother" or for some other species; but if kept in confinement for a few days, it will be found to be a bloated parasitised form, whence parasites are hatched.

It has been asserted by several observers that the larvæ of this species always assume wings, and that consequently the wingless specimens never give birth to young. In other words, only the fully developed female, which in this case is the winged specimen, gives birth to young. I have not fully verified this; but, so far as my observations go, I am inclined to endorse this view.

The apterous oviparous female may be found on the under side of the leaves just before they fall. It is easily recognised

by its darkish colour and elongated abdomen, prolonged into a tail. The eyes are bright red.

This insect rather lends itself to a study of ovarian characters.

The genus *Aphis*, according to Buckton, contains forty-five species, the following being the generic characters given by him:—

*Genus* Aphis, Linn.

"Rostrum moderately long; the last joint skittle-shaped, and as long as the preceding. Antennæ shorter than the body. Frontal tubercles none or rudimentary. Seventh joint setaceous, and as long as the third. Cornicles cylindrical, and equally thick throughout. Cauda short, sometimes hardly visible, legs moderately long. Wings generally shorter than the preceding genera, but veining similar."

In several districts in Cheshire, during the seasons 1893-94, very much damage was done to young thorn hedges and young quicks by the *Aphis cratægi* Kalt., young thorns in many cases being killed outright. There is no mistaking this pest. In consequence of growth being arrested, the shoots are comparatively short, the leaves curl up, and in general appearance the infested plants look as if the leaves and young shoots are covered and killed with fresh soot.

If infested plants are examined during the winter months, the topmost portions will be found studded with dark-brown eggs. These eggs hatch out as soon as the leaves burst, and throughout the summer the insect pest, in all its various stages, may be found. It is very variable in colour and appearance. Hence Mr Buckton remarks that "it is exceedingly difficult to reconcile the descriptions of various insects named *Aphis cratægi* Kalt. by authors."

The apterous viviparous female is a bright-green-coloured insect with brown eyes. The antennæ are shorter than the body. The third and seventh joints are the longest. The cornicles are comparatively long, cylindrical, and equally thick throughout. The tail is short but conspicuous.

The pupa in many respects resembles the apterous specimens, but on the whole is very much smaller in size.

As I have not made any descriptive notes on the winged form when examining the living insect, and mounted specimens lose all colour, I append Mr Buckton's description.

"Head, neck, ring, thorax, and its lobes black; head broad and convex, abdomen shining bright green, with the same marked carination, and minute pore-marks of the larvæ. Cornicles long and straight, colour olive green, antennæ and legs ochreous, pale, and hairy. Rostrum reaches to the second coxa. Tail conspicuous and green. Eyes bright red."

With regard to remedies for this pest, we must either kill the insect in the stages of its metamorphoses or destroy the eggs. The insect form may be considerably checked by syringing the foliage with a mixed solution of soft soap and quassia chips. On the other hand, the eggs may be got rid of, so far as young hedges are concerned, by simply "cutting down" the young thorns and burning the prunings. In transplanting thorns previously cut down, care must be taken to lift plants with the best possible roots, and encourage as much as possible by attention and good management. This plan I have adopted with considerable success. However, under ordinary circumstances it is certainly not advisable to cut down quicks the same season as they are planted, inasmuch as the shoots produced are not so strong as those grown the following year, thus incurring the risk of plants being destroyed by insects, and rendering them more susceptible to be eaten by rabbits.

The tribe Schizoneurinæ contains the dreaded American blight, found on fruit-trees, and the damage done to stem and roots is unfortunately only too well known.

The arboreal species chiefly confine their injuries to the foliage. The curling and gnawing of the leaves of elm (Plate III., fig. 1) is a very conspicuous feature throughout the country. If the curl arises from the gnawing of one stem-mother, then a single straight roll of half the leaf is the result; but if the same leaf is seized by more than one stem-mother, then the deformed leaf assumes various distorted shapes.

The arboreal species most injurious in this country and throughout Europe is the *Schizoneura ulmi* Linn., and the most injurious arboreal species in America is known as *Schizoneura americana* Riley. The description given by European writers was suggestive of the two species being identical; but Professor Riley, on closer examination, found that the two species differ from each other in their methods of damage and structural details, thus showing that while we deplore specific hair-splitting, hasty grouping is far from commendable.

Considered as a pseudo-gall, the chief difference in the two species is that the stem-mother of *S. ulmi* attacks the upper side of the leaf, and the injured leaf in consequence rolls over, whereas the stem-mother of *S. americana* attacks the under side of the leaf, and the injured portion rolls under.

The queen-mother may be found about the middle of May. She is apterous, of a dark olive colour, mottled with dark-bluish tints, like the gloss on black grapes. The creature is considerably larger than any of her offspring, which may be found either along with or after her death. The body is slightly covered with a cottony exudation, arising from a series of pores on the back. In comparison with the body the head and thorax are

PLATE III.

FIG 1.—Leaves of Elm rolled by *Schizoneura ulmi* Linn.
" 2.—Gall on leaf-stalk of Poplar caused by *Pemphigus bursarius* Hartig.
" 3.—"Cork-screw" gall on leaf-stalk of Poplar caused by *Pemphigus spirothecæ* Koch
" 4.—Gall on mid-rib of Wych-elm caused by *Pemphigus pallidus* Haliday.
" 5.—Galls of *Tetraneura ulmi* De Geer, on upper side of Elm leaves
" 6.—Under side of Oak leaf covered by *Phylloxera punctata* Licht.

very small. The antennæ and legs are very short, hence the creature is very helpless. The antennæ are composed of six joints, the third being nearly half the entire length.

It is highly probably that those stem-mothers hatch from eggs laid the previous autumn.

The winged specimens may be found very plentiful by the middle of June, in the rolled elm leaves. The body of the female is wholly black in colour. The eyes are also black. The abdomen is very much ringed. The third joint of the antennæ is long, being considerably longer than all the other joints put together, and beautifully ringed. The wings are moderately long, and the cubital vein is but once forked, which is an important point in generic classification.

Closely allied to the preceding group are the *Pemphiginæ* or gall-forming aphides. The insects live sociably; but instead of rolling leaves form galls—growths which, from a structural point of view, may be considered higher in the sc .. of organisation than rolled leaves. The curious abnormal growths caused by insects belonging to this tribe, appearing on the leaf-stalks or mid-ribs of the leaves, often displaying beautiful colours, have given rise to a great deal of attention from various workers. The galls themselves, differing from one another in appearance and position, give rise to specific characteristic distinction, apart from the structural points of the respective insects themselves.

In comparing the generic characters of the two tribes, it will be ascertained that the rostrums are alike, and the antennæ similar—viz., six-jointed—but the sixth joint in Pemphigus is larger than in Schizoneurina. It is, however, in the wings that the most salient structural difference may be recognised. The cubital vein in Schizoneurinæ is forked once, whereas in Pemphiginæ it is not forked; but in both tribes the cubital vein is unattached to the cubitus.

*Pemphigus bursarius* Hartig is found on the leaf-stalks of poplar (Plate III., fig. 2), chiefly the black Italian species, and also on the young woody twigs of the Lombardy poplar. The gall is smooth, globular, highly coloured, and with an opening at the side. In July or August the leaves with galls on the foot-stalks, having fallen prematurely, may be picked up, and the insects found in all their respective stages of metamorphoses.

The stem-mother is larger than any of her progeny. The legs are short, and the creature comparatively helpless. The antennæ are four-jointed, and the cornicles absent.

The pupa is of a pale-green colour, with a slight mealy dusting, and shows signs of wings at a very young stage. The antennæ

are longer than in the green aphis, but the joints are not easily distinguished.

The body of the winged viviparous female is black, and dusted over with a white powdery matter on body and wings. The antennæ are six-jointed, the third joint being the longest, and the third, fourth, fifth, and sixth are ringed. Buckton says the sixth joint is smooth; but in the specimens I examined this joint was ringed like the others.

I found this species very common on poplar-trees near Peterborough.

*Pemphigus spirothecæ* Koch, like the preceding species, is also found on the leaf-stalks of poplar of the black Italian species (Plate III., fig. 3), but it makes a corkscrew-shaped gall. This species is far from common, and very locally distributed. While living in Cheshire, I found but one tree, which grew on a bank alongside a brook, a favourite habitat for this species of gall, which annually yielded me a good crop. The green aphis punctures one side of the leaf-stalk to obtain nourishment, and the stalk in consequence bulges on the opposite side. The gnawing and bulging cause the stalk to form a corkscrew-shaped gall, and the stem-mother and her progeny find a home and shelter in the folds. As the fully developed insects are about to escape, the galls become more elastic and open easily. The gall is of a dull green colour, and may be looked for from June to September.

The tribe *Chermisinæ* come nearest to the Coccidæ, or scale-insects, in point of anatomical structure, and nearer in general appearance of damage, than any other tribe in the whole family. Thus the snowy appearance presented by the "felt scale" on beech, and the white fluffy matter on silver fir and Weymouth pine, are to the naked eye practically identical. The difference between the two families can be decided only by microscopical examination; hence the importance of the microscope in forest entomology.

In structure the *Chermisinæ* are characterised by the upper wing having three oblique non-furcated veins, and the under wing a single oblique vein. The antennæ are five-jointed. The rostrum is very short. This organ is used exclusively as a feeding organ, and as an anchorage the creature develops three or more long hairs, or setæ, as they are termed, by means of which it maintains a hold on the bark. In this respect it very much resembles the Diaspinæ, or scale-insects on the ash, alder, willow. There are no cornicles.

During early May the leaves of beech-trees may be found covered with a white woolly coating produced by an aphis

called *Phyllaphis fagi* Linn. (Plate IV., fig. 3). In some cases large beech-trees are so badly attacked as to be partially defoliated in midsummer, and this being the growing season, the cubic contents of the tree must be appreciably affected.

*Chermes abietis* Linn.—This is a gall-forming species on the common spruce, *Abies excelsa*, the gall being in appearance like a pine-apple or pseudo-cone of Scots fir cone (Plate IV., fig. 4), each abortive shoot terminating in a cluster of modified leaves.

The stem-mother hibernates during the winter months on the young shoot, just immediately below where the psuedo-gall will be formed next year. They are, however, very difficult to find, as they are not only small but beautifully concealed. Shoots in close proximity to the old galls of the previous year are the most likely to yield specimens.

The first appearance may be looked for, according to season, about April 20. This is recognised by a small white speck at the tip of the shoot (Plate IV., fig. 5), in which the mother chermes may be found depositing the eggs. On examination about a month later (my dates were April 20 and May 18, and locality Cheshire), the mother chermes was still surrounded with eggs, although none were hatched. Meanwhile the cottony down had increased in quantity, the young shoots had grown from 1½ to 2½ inches in length, and the pseudo-cone or gall itself from ⅜ to ½ inch, whence arose deformed leaflets about ⅛ inch in length.

It is probable that constant irritation causes gall-formation. The young larvæ are hatched outside the pseudo-gall, and it is not quite clear how the vegetable structure reacts against the insect attack; but the gall slightly opens at the slits, and the young larvæ creep in. Afterwards the gall closes up, and the transformations take place within. It is computed there are about 2000 inhabitants to each gall.

Mr Buckton remarks: "It is not quite clear if the queen-mother dies outside of the developing gall, leaving thus the young which hatch from the eggs to enter those chambers alone, or whether she accompanies them in their retreat."

From the middle of June to the middle of July the winged specimens may be found emerging from the gall. They are

---

*Description of Plate IV.*

FIG. 1.—Terminal leaves of shoot of Wild Cherry rolled by *Myzus cerasi* Fab.
" 2.—Typical aphis damage on shoot of Blackthorn.
" 3.—*Phyllaphis fagi* Linn on under side of Beech leaves.
" 4.—Pseudo-cone on Spruce caused by *Chermes abietis* Linn.
" 5.—First stage of ditto
" 6.—Portion of Larch stem covered by cottony matter, underneath which stem-mothers of *Chermes laricis* Hartig live for winter
" 7.—*Chermes corticalis* Kalt. on Weymouth Pine

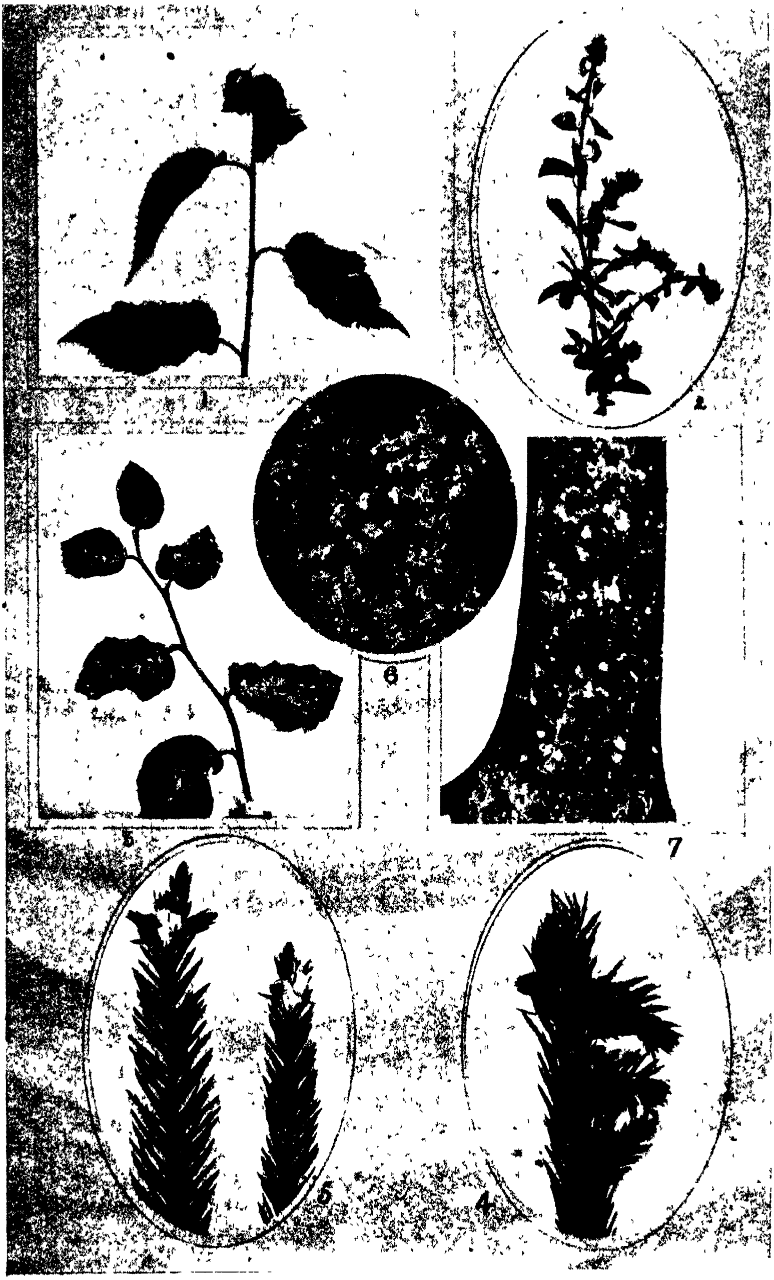



PLATE IV. (For description, see footnote, p. 40.)

very sluggish in their movements, and the wings are often folded roof-wise over the body.

The winged females spread themselves over the tree, and, after finding suitable places, deposit eggs and die. The dead bodies form a protection for the eggs and the young larvæ, which are hatched in autumn. Those larvæ which survive the winter become the queen-mothers in the following spring. In this respect they resemble the *Chermes laricis*, but they are more difficult to discover.

The pupal form presents a reddish-brown-coloured creature, whose body appears "all made up of a piece." The eyes are of a darker brown colour than the body. The antennæ and legs are short, and the wing-cases slightly greenish; but specimens differ very much in colour. As might be expected, the insect is more or less covered with a resinous exudation.

The winged imago is of a golden-brown colour, which deepens very much with age. The head is broad, and the eyes dark-brown. The antennæ are short and five-jointed, the last three joints being peculiarly straight on one side. The prothorax is comparatively broad and large. The abdomen is oval-shaped. Specimens mounted for some time show the abdominal segment to have a rather broken outline, and ending with a short ovipositor. The wings are comparatively broad, and vary in colour from a light to delicate greenish tinge. The venation is typical of other Chermisinæ.

*Chermes laricis* Hartig.—This and the remaining species of chermes differ from the preceding, inasmuch as Abietis is gall-forming, and those about to be considered protect themselves by a woolly covering. The evidence of the presence of Abietis cannot be recognised by the naked eye until we find a white speck in late spring. This white speck reveals the abode of the queen-mother. With regard to *Chermes laricis*, on the other hand, the queen-mother may be found throughout the whole of the winter months on the stems of young infected trees, their presence being indicated by the cottony covering on the stems (Plate IV., fig. 6).

In Cheshire by about March 25 the queen-mothers may be found just beginning to make "a move." At this time they are very small, and much resemble the larvæ hatched out from eggs later on in the season.

If the infected trees be examined about three weeks later, it will be found that the tufts of leaves have grown from about a quarter to three-quarters of an inch in length. The queen-mother chermes, having migrated from the leaves, will be found at the base of the leaf-buds surrounded by eggs. Her body is now very much enlarged, and of a dark-brown colour, with

conspicuous rows of tubercles, and slightly dusted with cottony down.

The antennæ are very small, and partly hidden. They are three- or four-jointed; but the joints are not easily determined by the one-inch objective. The rostrum is short and stiff, with very long setæ. The legs are short, and naturally not seen outside the bodily circumference. The tail is short, but is used by the insect in arranging her eggs, with which she ultimately becomes half buried.

The eggs are greenish in colour, glued together by a resinous turpentine, and further attached to each other and to the plant by delicate threads.

The antennæ of the queen-mother are three-jointed, the last joint being longer than the other two.

The larval forms which hatch from the eggs are mere pin-points in size, and a darkish colour. They spread themselves all over the tree, and do immense damage by sucking the juices of the plant.

The pupæ may be looked for about the end of May. They are of a darkish-grey colour, and the body is covered over with warty tubercles. The antennæ are comparatively long, but no indication of joints can be seen under the one-inch objective. The wing-cases are placed very low on the mesothorax, and lie very close to the abdomen, thus giving that portion a square-looking appearance, and also suggestive of the abdominal form of the "staph" beetles.

The Chermisinæ just referred to have a very important bearing in connection with "larch disease," inasmuch as it has been thought by some that the larch-tree may be inoculated with the spores of Peziza through the medium of the chermes step-mother. It has also been asserted that the chermes on spruce *alternates* with the species on larch. Both statements require ample verification, and therefore present a field of original inquiry to the aspiring student.

## SCALE-INSECTS (COCCIDÆ).

There is perhaps no class of insects more puzzling to the practical husbandman, the economic entomologist, or the biologist who is anxious to gain a general knowledge of insect structure and life-histories, than the Coccidæ or scale-insects.

They depend entirely on the microscope for the essential points in the discrimination of genera and species. Even for general field-work it is necessary to have recourse to a strong pocket lens, for to the naked eye they may be confounded with lenticels, as for example those on birch twigs. They may also

be mistaken for certain micro-fungi on leaves or stems of various plants.

The arboreal feeding species of this important family are comparatively few, and therefore in order to thoroughly understand the essential salient points of forest scale-insects it is necessary to glean information from all accessible sources. In other words, in order to thoroughly understand the special part it is essential to make a general study of the available whole.

But though the arboreal species in this country are comparatively few in numbers, the forester or student of forest entomology can always get easy access to garden greenhouses, —the amateur greenhouse often being a very happy hunting-ground.

Temperature and climatic conditions are important factors in the distribution and regulation of scale-insects. Hence warm greenhouses afford several important advantages to the student. Thus the temperature is, comparatively speaking, perpetual summer; and we find several broods thro hout the year, as well as the creatures in their various stages of metamorphosis. In the forest, on the contrary, many species are not only local in area, but sparsely distributed, and all are single brooded. In hothouses, through importation, plants are collected from various parts of the world, and thus to some extent we get in private greenhouses and public botanical gardens an approximate epitome of the scales of the world.

It is therefore evident that in order to understand the life-history of many scales originally imported, but now acclimatised to our glasshouses, recourse must be had to foreign and colonial literature. Not only is it advisable to study the literature relating to foreign scales, but it is essential to study the microscopical structure of the foreign scales themselves which are to be found on our imported plants and fruits. And as the dead females answer best for microscopical examination, greengrocers' stalls may be looked upon as a very happy hunting-ground, more especially at a time of the year when life is dormant and when the working entomologist may use his microscope as an instrument for original research in a comparatively fresh field.

The Coccidæ or scale-insects belong to the order Hemiptera, which is subdivided into two principal divisions—viz., Hemiptera-Homoptera, which includes Aphidæ, Cicadæ, Psyllidæ, and Coccidæ or scale-insects. The latter are broadly distinguished from the other families by the *scale* or *covering* which they spin to protect their bodies. Hence the Germans call them by the expressive term "shield-lice."

As in point of structure and life-history they are very closely associated with other families of the sub-order, it might be

well to present the more salient features of each family as an educational advantage to the clearer discrimination of generic characters. All the insects of the whole order are characterised by the possession of suctorial mouths, and therefore belong to that great division of Insecta known as Haustellata.

The Aphidæ or plant-lice are soft-bodied insects, usually green, with long legs, rather slender, and not formed for leaping. They are known in two forms — winged and wingless. The beak, or feeding organ, is often very long, and the tarsus two-jointed.

The Psyllidæ very much resemble the Aphidæ in general appearance; but their legs are well formed for leaping. The wings are clear, the antennæ conspicuously long, nine- or ten-jointed, and the eyes large and prominent. The tarsus is two-jointed.

The Cicadæ differ from the two previous groups by their wings beings coriaceous, especially the upper wings or elytra. The tarsus is three-jointed.

In general appearance the Aleyrodidæ are the most closely allied to the scale-insects, inasmuch as their bodies are of an ivory-white colour, scaly-looking in appearance, but are winged in both sexes and the tarsi two-jointed.

The Coccidæ are broadly distinguished from the other families of the Homoptera by the following characteristics—viz., by their waxy covering or scale, composed of tufts or plates, either spun by the female as a distinct protective covering, or else by the development and transformation of the chitinous covering of the insect itself. The tarsus in all British species is made up of a single claw, but in two foreign genera the tarsi are two-jointed.

The larvæ are minute and very active when young, usually naked, and the sexes are inseparable in the larval stage.

The female undergoes a semi-complete metamorphosis, is apterous in all stages, has generally a well-developed rostrum, and, according to genus, the legs may be present or absent.

The adult male undergoes a complete metamorphosis, and may be winged or apterous. It has no mouth or feeding organs, but possesses six legs, eyes, and antennæ.

It is important to bear in mind that both sexes secrete a varying quantity of waxy, horny, mealy, or resinous substances, for the formation of their shield or covering, and that those secretions or coverings vary in form and colour. In fact those differences in form and colour are so clearly pronounced that they afford valuable data not only for the distinction of sex, but for the separation of the various sub-families and genera. These remarks are applicable to the "scales" of both sexes, but more especially to the male scale or puparium.

The study of the Coccidæ is entirely microscopical, Muskell[1] giving the following characters:—

1. The presence of only one joint in the tarsus, or fourth joint of the leg, in males and females.
2. A single claw terminating the leg in males and females.
3. Two wings and two halteres in the males.
4. Two or more eyes or ocular tubercles in addition to an ordinary pair of eyes.

## CLASSIFICATION.

### *Synopsis of Sub-families.*[2]

(*A.*) Males with simple eyes.

(*a*) Abdomen of female terminating in a compound segment forming a definite pygidium. Orifice simple.

Insects with a separate covering scale (puparium), composed partly of moulted skins (exuviæ) and partly of secretions. Adult females without legs; antennæ rudimentary; mentum monomerous . . . . . . . . **Diaspinæ.**

(*b*) Abdomen of female without definite pygidium. Anal orifice setiferous.

Females with posterior extremity cleft; anal orifice closed by a pair of dorsal plates. Larvæ with prominent setiferous lobes within the anal cleft . . . . **Lecaniinæ.**

Adult females without cleft extremity or anal lobes; anal orifice non-setiferous. Larva with anal lobes, and setiferous anal orifice, as in the Dactylopiinæ. Include the genus *Kermes* only[3] . . . . . . . . . . **Hemicoccinæ.**

Abdominal extremity not cleft, usually with a pair of more or less prominent setiferous lobes at margin. Abdominal extremity of larvæ similar . . . . **Dactylopiinæ.**

The group **Diaspinæ** contains some very destructive insects, and is therefore a very important one to the arboriculturist. The following genera are arboreal in their habits, viz.:—

| | |
|---|---|
| Aspidiotus. | Diaspis. |
| Chionaspis. | Mytilaspis. |

The genus Aspidiotus is generally considered as the typical form of scale, but as the Chionaspis is more frequently met

[1] Scale Insects of New Zealand.
[2] Newstead's Monograph, vol. i. p. 67.
[3] Ibid., vol. ii. p. 138, as amended.

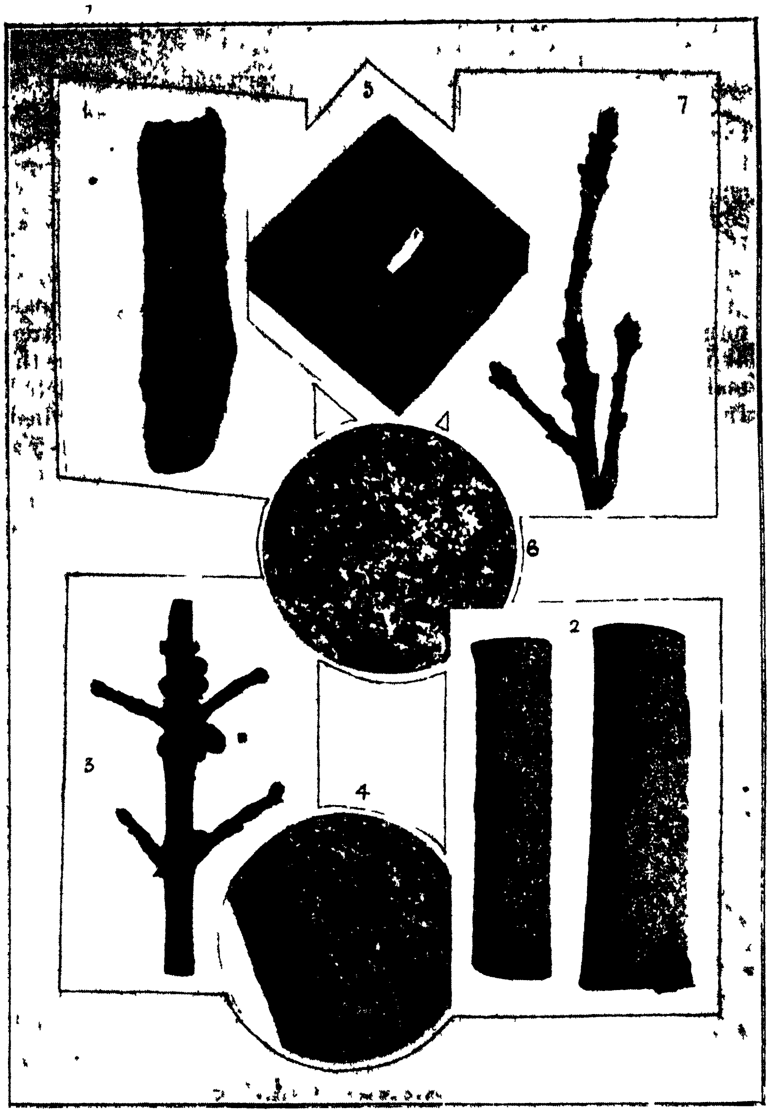



PLATE V.

FIG 1 —Mussel Scale, *Mytilaspis pomorum* Bouche (Hawthorn)
" 2 —Male scales or puparia of *Chionaspis salicis* Linn (Ash)
" 3 —Scales of *Lecanium* (Sycamore)
" 4 —*Apterococcus fraxini* Newst on Ash
" 5 —*Pseudococcus*, sp, on Hornbeam
" 6 —*Cryptococcus fagi* ("Felt Scale") on Beech
" 7 —*Asterolecanium variolosum* Ratz on Oak

with in our forest rambles, I may be permitted to adopt it, at least for our purpose, and consider it as the typical form of scale, giving a full account of its life-history and structure.

Chionaspis scales are very common on ash, willow, and other trees. In some parts of the country we find young ash-trees, from six to eighteen years of age, and osiers, from four years and upwards, completely covered with those scales. They are comparatively small, and if accurately measured would probably be about ·75 m.m. in length.

A cursory examination shows that two forms of scale appear on the stems—the male form (Plate VI., fig. 6) and the female form (fig. 3). Sometimes we find both forms on the same tree, at other times only one form is found. In those cases where the male form preponderates, a whitish appearance is presented. In Plate V., fig. 2, the male scales or puparia, as they are called, entirely cover the bark of the young stem.

If we lift a perfect female scale (Plate VI., fig. 3) any time during the winter months, turn it over, a [1] examine it with a lens, or as an opaque object with an objective, a considerable number of beautiful red eggs will be noticed (Plate VI., fig. 4). In my younger days, when working in the woods, I often rubbed the thumb-nail against the bark infested with Chionaspis, and sincerely designated the squashed eggs as "blood." Subsequent research with the microscope has yielded many happy hours with what was originally crushed in a careless and thoughtless manner. These eggs are of a chocolate colour in autumn, just after oviposition, but become lighter during the winter months.

Now let us follow the development of these eggs. Plate VI., fig. 1, represents a single egg. The larvæ hatch out about the beginning of May, and by the middle of that month the infested stems may be recognised at a considerable distance by the number of larvæ imparting quite a red colour to the stem. These larvæ (Plate VI., fig. 2) are at first very active, and would approximately measure about $\frac{1}{100}$ of an inch in length. They possess six legs (the tarsus being single-jointed, and terminated by a claw, and knobbed hairs), comparatively long antennæ of five or six joints, two eyes, and two very long transparent hairs at

*Description of Plate VI.*

FIG 1 - Egg of *Chionaspis*. FIG 2 - Larva
" 3 —Female scale (*a*) first larval moult, (*b*) second larval moult
" 4.—Female scale, showing dead female and eggs.
" 5 —Female insect magnified
" 6 —Male scale
" 7 —General idea of anal segment or pygidium of ♀, very highly magnified, showing "spinnerets"

FIG 8 —Mite *Chionaspis*
" 9 —Female scale of *Aspidiotus* (typical).
" 10.—Male scale of *Aspidiotus* (typical).
" 11 —Antenna of *Pseudococcus* (Mountain Ash).
" 12 —Outline of rostrum of *Pseudococcus* (Mountain Ash)
" 13. - Leg of *Pseudococcus* (Mountain Ash).
" 14 - Anal segment of *Cryptococcus fagi*, copied from Karl Sulc.

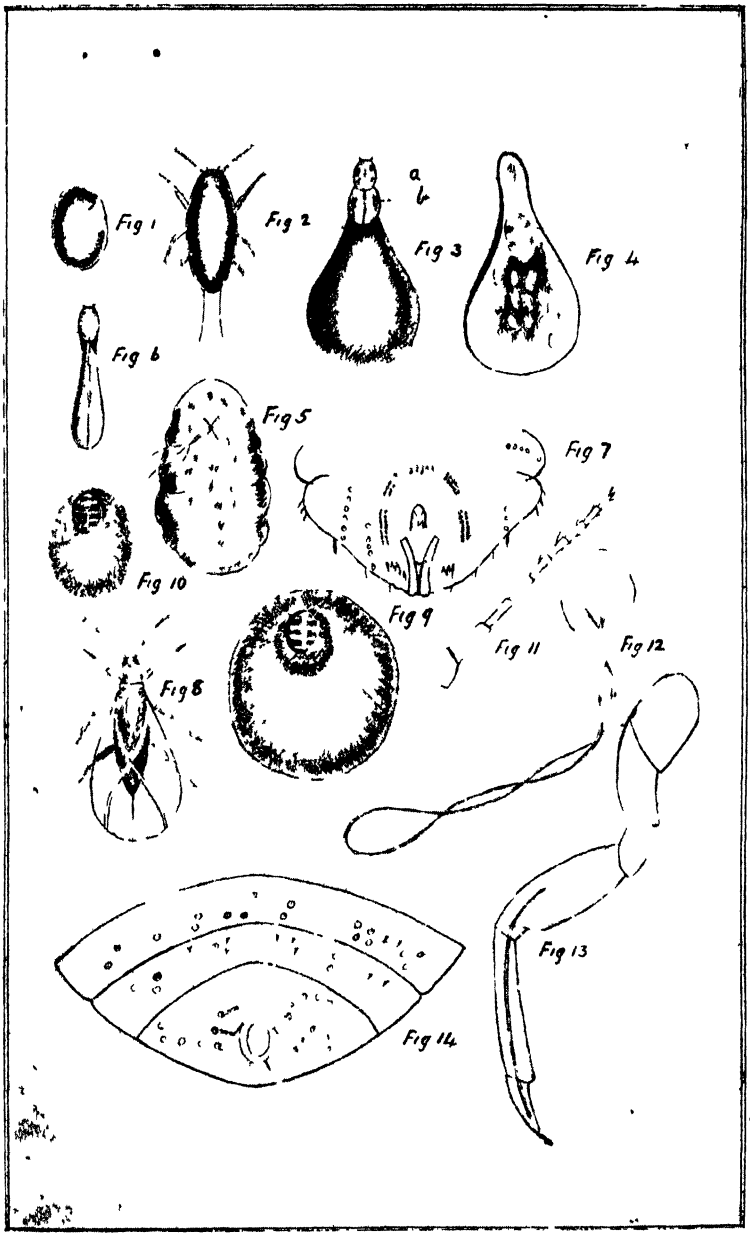



PLATE VI. (For description, see footnote, p. 48.)

the posterior end. Under imperfect magnification the segmentation of the abdomen cannot be very clearly traced. In the course of two or three days they assume a quiescent state, and, inserting their beaks into the bark of the tree, suck its juices. As soon as the larvæ assume this habit they enlarge considerably; the legs are apparently lost, and the antennæ become less conspicuous.

After the larva has grown for a short time it casts its skin, and it is after the first larval moult that the sexes are determined. The female scale develops into the form shown in Plate VI., fig. 3, and the male as shown in fig. 6.

Now let us follow the development a little more fully, and first with regard to the female. After the first larval moult (which is represented by Plate VI., fig. 3, *a*) the creature develops, and again moults—the second larval moult being shown by *b* in the same figure. Up to this stage the creature protects herself by means of cast-off skins; but she now commences to further protect herself by means of a covering or "scale," which is spun by minute organs known as "spinnerets," represented in a general way by Plate VI., fig. 7. After the second larval moult the metamorphosis of the female insect is complete. The full development is shown by fig. 5, from which it will be seen she is simply an inert slug-like creature, made up solely of body and mouth.

The rostrum or mouth serves the double function of feeding organ and anchor; but in the latter capacity it is further assisted by three long hairs or "setæ," and sometimes when the females are loosened from their host plant by birds, they may be seen dangling in the air attached by the setæ alone.

Prior to the deposition of eggs, which usually takes place in September, the body entirely fills the ovisac; but as the eggs are deposited, the body gradually shrivels until it ultimately occupies but a very small portion at the upper end of the scale. The female soon dies after the eggs are deposited, and during the winter months the dead female and eggs may be found under each scale.

If a microscopical examination of the female be made in the winter months, the well-developed rostrum will be observed; but a special examination of the anal segment or pygidium (Plate VI., fig. 7) shows *five* groups of spinnerets, the number peculiar to Chionaspis.

It ought to be laid down as an axiom that only the full-grown female should be examined for specific points, as the spinnerets and other microscopical characters are not fully developed until after the first larval moult; and no doubt specific errors have occurred, and are likely to do so, by several workers examining the same species in two distinct stages.

The male differs very materially from the female. The male scale (Plate VI., fig. 6, and Plate V., fig. 2) differs from the female (Plate VI., fig. 5) by having only one larval moult, by being lighter in colour, more lineal, and carinated. The perfect male (fig. 8) contrasts with the female, inasmuch as it has two wings (though apterous specimens are often found), six legs, and two antennæ, two eyes, and *no* mouth or feeding organ. The male generally appears about by the first week in July, and only lives from about three to seven days; but during that short space of time it has obtained the sole object of its existence—viz., the perpetuation of the species.

The *genitores* are large in proportion to the size of the creature, varying from about one-third to one-half the length of the whole insect. We here see the adaptation to environment in the abnormal development of the genitalia requisite, considering that the female is stationary and helpless, and covered with a shell, while we note in her the absence of eyes and legs, both useless under an opaque shell. Hence we have a beautiful illustration of the elaboration of one part and the degeneration of others.

It may be as well to remark that previous to the publication of Newstead's monograph this species was known as *Chionaspis fraxini* Sign., and that we had several species according to the food-plant, as, for instance, *C. furfurus* on privet; but that those have now emerged into the one species of *Chionaspis salicis* Linn.

The *Mytilaspis pomorum* Bouché (Plate V., fig. . ), or common mussel scale, is unfortunately only too well known as a garden pest. It infests apples, pears, and plums amongst our fruit-trees, and hawthorn, mountain-ash, cotoneaster, and wild-rose amongst our forest trees and shrubs. The common term "mussel-scale" is a very appropriate one, inasmuch as it resembles, when magnified, our common mussel of the sea-shore.

The scale differs from the Chionapsis in being more elongated, less circular, of a brown colour, and about an eighth of an inch in length. It is built up in the same manner as the ash-bark scale, but the first larval moult is yellow in colour.

In the foregoing account of scale-insects it must be remembered that the "scale" is a covering made by the female insect for the protection of the body. Now we come to a group of which the *actual body* of the female is transformed into a *covering* or *scale* for the protection of eggs and larvæ. This group is known as **Lecaniinæ**, of which Plate V., fig. 3, is a typical example, found on sycamore.

The scales of *Lecanium capreæ* Linn., found on sycamore, hawthorn, and other plants, have a general resemblance to

brown dead buds. If those brown scales are gathered about the beginning or middle of July, and placed in a glass-covered box, and examined towards the end of July or beginning of August, it will be literally swarming with small chocolate-brown-coloured active larvæ, about $\frac{1}{100}$ of an inch in length. Under the one-inch objective the structure of those larvæ very much resembles that of Chionaspis. They move about very actively for a time, then settle down, and begin to imbibe the juices of the food-plant. After this stage, and up till the following May, the small larvæ just referred to are somewhat difficult to find on the tree. They are not only very small in size, but lie closely to the bark, and resemble it very much in colour—in fact, it is only on thorn hedges, and other strongly infested plants, that they can be found without very careful search. In spring careful investigation reveals two forms of small scales: the one glassy-looking and somewhat elongated, the other shorter and of a darker colour. The former are male scales, the latter female. Before pairing the femal would probably measure about $\frac{1}{20}$ to $\frac{1}{30}$ of an inch in length; but after copulation they grow rapidly, and when fully developed would measure about $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in diameter.

If examined at this stage it will be seen that the whole surface rests on the bark; but as the eggs are deposited the interior substance gradually shrivels, and finally only the outer edge of the scale—the hard chitinous substance—touches the bark. The eggs, and afterwards the larvæ, are protected by this outer shell, and thus the *actual body* is transformed into a covering for the future progeny.

If kept under glass, about this time it will be found that the scale itself appears perforated, and the case swarming with small hymenopterous parasites. Hence, probably, the harmony of colour in the early stage was a means of protection against natural enemies.

As it is the microscopical characters which determine the species, mention may be made of the most salient features. There is a comparatively long abdominal cleft, with two lobes at the end. The antennæ, legs, and mouth all require the most careful microscopical examination. The antennæ, as a rule, are composed of seven joints. In some species they are long and slender, in others short and robust. The specific variation shows great diversity in the length and outline of the respective joints: some show the middle joints the longest, others the first and last joints the longest or shortest respectively. The specific differences of the legs are shown by the comparative length of tibiæ and tarsi. The tarsal digitules and hairs are also taken into consideration as specific characters.

The other important genus belonging to the group Lecaniinæ

is known as *Pulvinaria*. The scale itself resembles the Lecanium, but in the adult stage of the female there is an ovisac attached to the scale. Thus the Pulvinaria is one-half brown scale, one-half white ovisac.

Prior to the deposition of eggs the scale of this genus is exactly similar to the Lecanium in general anatomical structure, but the eggs are covered and protected by a white ovisac.

The species on trees are known as *P. vitis* and *P. vitis* var. *ribesiæ*. The latter species is generally found on red-currant or the wild flowering currant. The insects on either of those food-plants may be used for the purposes of a detailed study of the life-history of Pulvinaria.

In the next group, known as **Dactylopiinæ**, of which the "mealy bug" is the type, we have several arboreal genera and species, all of which are interesting in their structure and life-histories.

In Plate V., fig. 7, we have a scale insect known as *Asterolecanium variolosum* Ratz. The female scale adheres very closely to the young twig, so much so that she actually causes a depression to be formed; and, where they are numerically strong, often kill the twig. The appearance presented may be compared (if the simile is not considered too grotesque) to the features of a person who has suffered severely from smallpox.

In Plate V., fig. 5, a typical example of scale known as Pseudococcus is represented. It is simply a small white speck on hornbeam, and may also be found on sycamore, mountain-ash, elm, oak, and other trees. In several parts of the country it may also be found on gorse. Though never so numerically strong as to be considered a pest, it has nevertheless an interesting life-history. The larvæ hatch about the middle of June, and they are mere pin-points in size, and of a light yellow colour. The antennæ are composed of six joints, the terminal joint being as long as three other joints. They have large prominent eyes, of a brown colour, with just a slight tinge of blue; the legs similar to other coccid larvæ. The body at first sight appears to be one piece, but is segmented abdominally and fluted, each flute terminating in a single hair.

The species illustrated on hornbeam, on which I tried to make a few observations, was taken from a tree in my garden. I found the larvæ hatched out about the middle of June, but I failed to discover their presence again until September. By that time they had enlarged considerably, and could be found in comparatively strong numbers, swarming on the lower region of the trunk. At this stage they are still larvæ; but the sexes then assert themselves. The males remain in the south or lee side of the trunk, and the females go higher up on the branches,

generally in the cleft. According to observations made daily on a laburnum-tree, passing to and fro from his own house, Newstead says that the females re-awaken in March, a few days before the males descend the trunk, copulate, and return to the branches. In May they spin their cocoon, which takes about three days, and then the larvæ hatch out about the middle or end of June.

*Apterococcus fraxini* Newst., Plate V., fig. 4. In some parts of the country this scale is very common on old ash trunks. In general appearance it somewhat resembles the genus Dactylopius, the bark being spotted with numerous white specks. If an individual sac be examined during the winter months, it will be found to contain two or more female insects. The adult female is a bright red colour, somewhat globular in shape, with six-jointed antennæ, short legs, and very long rostral filaments.

The males appear in considerable numbers during October and November. They are apterous, of a bright red orange colour, with black eyes. The antennæ show eight joints, and at the junction of the third and fourth joint a curious ball-and-socket arrangement may be seen.

In many parts of the country the trunks and larger branches of beech-trees will be found coated with a white covering, presenting the appearance of a shower of snow having frozen. This pest has been graphically called the "felt scale" by Miss Ormerod; and the coccid itself is named *Cryptococcus fagi*. Plate V., fig. 6, shows a photograph of the damage caused by the insect.

Where the pest is but sparsely distributed on the stem, little damage accrues; but it is sometimes found about a quarter to half an inch in thickness, and when such is the case the bark separates from the stem, and the tree ultimately dies in consequence. And as this is occurring in many parts of the country, the pest is becoming rather alarmingly injurious.

In moving the white covering, about midsummer, the insects may be found in all their respective stages. The adult female is of a sulphur-yellow colour, about half a line in length, convex above and below. The dorsal surface is covered with a fine pubescence; antennæ short and three-jointed; the legs are represented by short rudimentary appendages, embedded in a thick body (Plate VI.) Fig. 14 represents the anal segment of the adult female, according to Karl Sulc. Two black angulated eyes are seen. The insect, on the whole, is very helpless, and shows poor powers of locomotion.

The larvæ in shape and appearance very much resemble other coccid larvæ, being active and yellow in colour. The eyes are rather conspicuous, and of a purplish colour. The antennæ are five-jointed, and terminated by a forked bristle.

## Remedies.

Considering the alarming spread of this pest, *special* preventative and remedial measures ought to be taken, in order to save many specimen trees in pleasure parks and the forest generally.

A few years ago, as a remedy, I tried a solution which proved very successful. To make it, take about half a gallon of soft water, boil and dissolve about 1 lb. of soft soap and about 1 lb. of common soap; add a handful of sulphur, one pint of paraffin, and about the same quantity of turpentine. Then add about four gallons of soft water to this mixture. Churn well with a syringe, and, when cold, store away in a stoppered barrel to prevent evaporation. Apply with a whitewash brush about May, just as the larvæ are hatching out; but before application churn well with the syringe to ensure the mixing of the ingredients.

I did not measure out the ingredients in exact proportions, but took care not to add too much paraffin and turpentine.

A most interesting and successful remedial measure has been brought under my notice at Blagdon, in Northumberland. With an inch auger bore three holes, at about equal distance, right into the centre of the trunk, about three feet from the ground, and sloping slightly towards the root of the tree. Into these holes place as much flowers of sulphur as can be conveniently got in, and then cork them firmly up with a plug of soft wood. This should be done in the autumn, and will be found successful. It was first adopted about thirty years ago, and the trees which were then operated on are now in comparatively good condition. Prior to the experiment they were covered with the scale, were very sickly looking, and shed their leaves prematurely.

With regard to general remedies it is quite certain that every practical man will ask the question, How can we best get rid of those pests? As all insects are most injurious to sickly or badly grown plants, it is best to maintain good health and encourage vigour. It is also advisable to ascertain, as far as practicable, the natural enemies of insect pests, and encourage those friends which live on pests as much as possible. Those friends may either be insects or birds.

In the foregoing paper three great families of insect pests have been dealt with—viz., mites, green-fly, and scale insects. As regards remedies for these pests it is, perhaps, easier to give general than specific directions.

As regards general remedies, they may be classified under three main divisions—viz., (1) fumigating plants in a shed when removing from the nursery to the wood; (2) spraying, more especially in the nursery lines; (3) miscellaneous remedies,

as, for example, hand-picking of infested buds, burning of prunings and all dead branches lying in woods, together with the adoption of various methods of trapping the respective pests.

Amongst the mites, no arboreal species mentioned can compare with the species on black-currant, and even in this case various methods adopted have only met with partial success.

The two species most injurious in the nursery are those on yew and hazel. In both cases hand-picking would be the best remedy. If spraying be adopted, it should be done during the migration period, when the creatures are therefore least protected. Various mixtures will be preferred, but perhaps a liquid made of, say—sulphur 1 lb., soft soap 10 lb., ½ pint paraffin, and ½ pint turpentine, mixed and churned well with a syringe in 2 gallons of soft water, to which is added about 20 gallons of soft water, and applied with a fine syringe, would do a great deal to minimise the evil of Eriophyinæ.

With regard to the Aphidæ or "green-fly," perhaps a method of spraying would give the best results. Fumigation of bundles from the nursery would not do a great deal of good, inasmuch as the majority of those creatures pass the winter months in the egg stage. To those, however, which pass the winter stage as hibernating "queen-mothers" a certain amount of good might be done by fumigating. As regards spraying, there are a number of various insecticides in the market, and one is rather reluctant to recommend any one in preference to others. The great principle, so far as application is concerned, is to use plenty of soft water with ingredients that will act on the chitinous body of the insect. By acting on the chitine the creature is not only killed, but the future progeny within the body of the insect is also killed, and it is therefore advisable to try and exterminate those pests in this wholesale manner. Those made with quassia and caustic are very good.

As bearing on the question of plant vigour in connection with insects, I may mention that I had a large number of silver firs very badly infested with *Chermes*, and, being reluctant to burn them, I moved one portion to a light gravelly bank and all died, while the other half was transplanted on a field of heavy clay, and these "threw off" the insects the first season and did remarkably well.

With reference to general remedial measures for scale insects we cannot do a very great deal in the forest, and all recipes given in home and colonial literature are more applicable to greenhouse plants. At the same time, certain favourite trees in our parks or lawns may be badly affected, and it would therefore be advisable to try something, and in addition to the mixture recommended for the "felt scale" on beech, I

would advise the adoption of the following from Newstead's 'Monograph,' viz.:—

"1 lb. of ground caustic soda.
$\frac{3}{4}$ lb. of pearl ash.
10 oz. of soft soap.
10 gallons of water.
Apply at a temperature of 130° Fahr."

The above mixture should always be applied with a brush, or spraying, and, if at all practicable, it should be done just as the larvæ hatch out, as the insects are then least protected. Thus it is, we repeat, essential to study the life-history of the pest in order to get the best results, and hence we see the truth of the aphorism "Knowledge is power."

---

## THE HIGHLAND PONY.

By Thomas Dykes, Edinburgh.

Till the formation of Lovat's Scouts, a mounted regiment which did admirable service in the recent campaign in South Africa, it seemed highly probable that the Highland pony would be allowed to pass into oblivion. The Galloway, the Cleveland Bay, with many other breeds of minor importance, had their chief points and characteristics rubbed out in a desire for so-called improvement—*i.e.*, an increase in pace or power—and the hardy little steed of the glens and the islands seems to have been fast following in their wake. Whether this process of mongrelisation has been arrested in time is doubtful in the minds of many. Though widely scattered, there are, however, to be found a few of the old sorts,—more or less crossed, no doubt, with blood from the south,—and by judicious selection, backed up by some form of registration, it is to be hoped that the ancient stock will be rehabilitated. Possibly improvements will be deemed necessary, and if these are carried out in a guarded manner, good rather than harm may result, full consideration always being given to the climatic and pastoral conditions under which such ponies have hitherto been reared, the early labour required of them, and their subsequent market purposes and prices. Certain crosses introduced into the breed in the past have been much more harmful than others, and it is an object of those who have the interests of the old stock at heart to see that this in future should be discouraged.

In preparing a paper which is designed to embody the practical ideas of those who have a thorough acquaintance with the subject,

it is well at the outset to explain the position as it at present stands. The movement originated by Lord Lovat having proved successful, the Marquis of Tullibardine, M.V.O., D.S.O., acting with the consent of the military authorities, had formed together during his absence at the front a number of followers and others connected with the Atholl estates, by his father the Duke of Atholl, which proved the nucleus of "Tullibardine's Scottish Horse." This regiment, in consideration of valuable services rendered, was, like Lovat's Scouts, given a permanent place in the Army List of mounted volunteer regiments. Permission was further granted to amplify the movement to the number of 3500 men, and, thanks to the enthusiasm and hard work of Lord Tullibardine, recruits to this extent have been enrolled, chiefly from the ranks of the small farmers, crofters, foresters, keepers, and stalkers of the Highlands. As each trooper will be allowed £5 and full keep for a fortnight, also 5s. 6d. per day for fourteen days, this works out into a full annual grant of £31,000 (£17,500 horses and £13,500 wages); and no matter from what particular chest of the Treasury it is issued, it must largely be recognised as a gift to the agriculturists of the north of Scotland.

To secure the full amount of the equine grant, by raising the necessary remounts, ought to be the object of every one who has the farming interests of the Highlands and Islands at heart. The general spirit of the times speaks in favour of the home-made, home-bred, and home-woven article; and it seems almost as unnecessary for us to go into the southern counties, let alone to the Continent, to get hold of a pony for a Highland mounted soldier as for a Highland plaid. In a territorial sense, "the Highlands of Scotland" is a big wide phrase, and means a range of opinion as varied as the seascapes and landscapes lying between the east coast of the Outer Hebrides and the German Ocean. With fuller knowledge and well-directed council, no doubt something close upon unanimity, the proverbial Celtic preference for individual opinion fully considered, will be arrived at.

So far as the scope of this article is concerned, we have no reason to ask how the War Office authorities have fixed their standards for infantry remounts. An oft-quoted line of Tennyson's fully answers that question, "Their's not to reason why." Writing to us at the close of the South African war, when dealing with the question of a future remount supply, the Earl of Dundonald said:—

A mounted infantry cob should be between 14 and 15 hands, very strong, hardy, and able to do much work on a little food; stand exposure and be sure-footed, also be docile. English ponies are, as a rule, not so docile as the South Africans. I liked the native South Africans very much.

This corresponds almost exactly with the experience of Colonel Fraser-Tytler (of Aldourie), whose communication we shall have further to refer to. In answer to queries (1) as to what were the desirable form of remounts for Lovat's Scouts; (2) in what markets were your remounts for last training chiefly bought? he replies:—

1. Strong stuffy cobs from 14·1 to 15 hands. The polo type perfect, but scarcity and price prohibitive for troopers' mounts. The Highland garron, now also so scarce, would be a first-rate mount. The present type of Highland hill pony is mostly too heavy-shouldered and slow.

2. Purchased 200 cobs—mostly from Ireland, some from Wales, and some Government remounts that they had on hand at finish of war. Prices about £26.

No doubt the crux of the question at present largely is getting good riding shoulders on to the Highland pony and giving him a little bit of pace. In regard to the British navy at present, the chief problem seems to be in getting hold of ships that can avoid any ship they wish to evade and capture any vessel they wish to pursue. No man likes to run after an enemy long who is mounted on a better horse; his position is less enviable when there is a better mounted man of the enemy behind him. The Government buyers for regular service will no doubt give this full consideration. It may be recollected that the Lovat Scouts had to leave their remounts behind them at Southampton on account of an outbreak of pink-eye at Glasgow, where they were first entrained. On inquiry at the War Office we have been informed that the number of cobs taken over from Lord Lovat was 114, which were distributed amongst various units of the army; what has happened since this distribution cannot now be ascertained, as they were held for ultimate service in South Africa. In the same communication we were further told that mounted cobs should be for *peace* requirements from four off to six years old, for *war* six to ten years, from 14·2 to 15 hands in height.

So far as the raising of infantry remounts is concerned, the question is not confined to the Scottish Highlands, or indeed to any part of the country. Ireland, Wales, with Exmoor, Dartmoor, and the Fells of Cumberland, may in time desire to contribute, though meanwhile the standard height of the ponies in the countries or districts mentioned, save the Fells, is much under 14·2, and very rarely if ever up to 15 hands. The weight-carrying power and the pace are in proportion to stature; and it is not likely, therefore, that, unless a return was made to something like the old Forest Laws of Henry VIII.'s time in England and James V.'s time in Scotland, enjoining the castration of all colts unless up to a certain height, they would prove useful equine recruiting-grounds. Whether a return to so-called

"militaryism" would be resented by modern pony-breeders, who are very conservative, remains to be seen; but if there is a demand for an article at a remunerative price, we know from commercial history that it is generally met.

In the very early days of our nation's history the claims of war on our horse-breeders stood out pre-eminent. Agriculture possibly came next, the bovine race literally being displaced from the yoke. Then came the wants of convenience—conveyance, sport, and pleasure—with all its various modifications of the original equine types of animals, of which our best modern authority, Professor Cossar Ewart, says there were but two—one *large* and "big-boned," as best represented by the Shire, the Clydesdale, the Suffolk, or the Belgian; one *small* and delicately jointed, with fine limbs, which we find evidenced in the Arab, the Barb, and many others, not to speak of the very small ponies. Shoved as far south as the Pyrenees by the glaciers, they sought their food east, west, north, and south very much as an old brood mare with foal at foot would do in a boggy part of the Highlands at the present day. Some of the small breeds found their way at the close of the glacier period into Scandinavia, thence were ferried out into the islands for various purposes and under various circumstances.

The learned Professor alluded to has discovered that many of the large breed found their way into Ross-shire, and this type, largely identifiable in many features with our existing breeds of draught-horses, is not yet extinct.

In the Highlands of Scotland we have mostly to do with the smaller or No. 2 breed of the latter days of the glacier period, as near to the original type as possible, and as mixed with modifications of its own kind or combinations mostly accidental of the large and small breeds. The history of horse-breeding south of a certain degree of latitude is closely associated with the general history of most countries. This has to be kept well in view in dealing with the Highland pony, more especially when it is considered that it may have a military future in front of it. Before doing so it is almost essential that a few notes should be given of the gradual progress of horse-breeding in its various forms as carried out in all parts of Scotland, as also the Borderland. William the Lion (1200), whose royal headquarters was the ancient town of Lanark, was the first Scottish monarch who specially legislated for horse-breeding. Under certain penalties every burgess was bound to keep a horse for the rendezvous. To his judgment and sagacity we no doubt owe the original Clydesdale, which went through many modifications ere it was permanently established in its present type and form. So far as the burgesses of Lanark were concerned, this does not seem to have been a very great imposition, the colts and mares being

bred and reared on the meadow or "haugh lands" of the Clyde between Rutherglen and Biggar. The Lanark Silver Bells is the oldest racing trophy in the kingdom; and no doubt on Lanark Moss, which is two miles eastward of the ancient stronghold, many of those burgess-owned horses annually competed. The system of breeding Clydesdales in those days was maintained up till a very modern period, and the writer has had, in the town of Lanark, described to him by the late Bailie Somerville of Strafrank, a member of a very old Clydesdale-breeding family how the colts and fillies were driven loose into Lanark Fair, the dealers generally watching the leading colts, which seemed to single themselves out from the main herd. No doubt "King William," who had extensive possessions in France, brought in stallions, which may now be readily identifiable with the Norman and Percheron breeds.

The superiority of Scottish hill-bred horses for active work, as against the ancient Fen types, seems to have been very early established, and the horse-trade between England and the South, not to speak of other countries, became a matter of national importance. In 1369 David the Bruce thought that the country was in this way drained of much of its defensive power, and exportation was forbidden. James I. of England was the first to give relief against this by letting into open market all three-year-olds fit for use. Leaving out the beneficial effects of the enactment of William the Lion, we owe the most of what is superior in modern Scottish horses to the Stuart period. Between the time of James I. of Scotland and James I. of England we had brought in from the Court stables of all Continental countries with which Scotland held friendly relations the best specimens of every known breed. These were diffused throughout the country much after the manner in which King's Premium Stallions are distributed at the present day. In his "Early History of the Clydesdale or Scottish Breed of Horses," which serves as the introduction to the Index volume of the Clydesdale Stud-Book, the writer has dealt very fully with this question.

It may be interesting, however, to allude to more modern history as affecting the character of the Highland ponies of the mainland and islands. In a small way black horses from Flanders seem to have been introduced into Scotland about the middle of the seventeenth century. All historians reproduce the tradition that one of the Dukes of Hamilton brought into the country twelve black stallions, which he stationed at Strathavon Castle. No evidence of this, however, exists, but it does not seem improbable that they may have been brought to Bo'ness, then the great east coast harbour holding direct communication with Flanders, and stationed on his Grace's Linlithgow estates.

The Scottish Black Horse Wave, however, had its real origin about the year 1780, and in 1786 Bakewell had two of his black horses stationed on alternate days at the Crown Inn, Linlithgow, and "quarters" in the Grassmarket, under Edinburgh Castle. At Dalkeith Palace stables the Duke of Buccleuch had, together with a coaching stallion and an Arab, son of Snap, "a Bakewell Black Horse"; and Colonel Fullarton, through in Ayrshire, who furnished Sir John Sinclair with the Ayrshire report on Agriculture, possessed another, though more of a dark bay. In 1820 we had "black horses" in many parts of Scotland. These were specially recognised as different from the pre-existing breeds, and were alluded to as Jones's Black Horse or Robinson's Black Horse, and in Bakewell's advertisement it is stated that "this is the best black horse ever introduced into Scotland."

The Black Wave passed over into Kintyre with the two black stallions introduced in 1820 by Sir Charles Macdonald Lockhart of Lee on the Clyde, to his then Largie estates, and no doubt helped to form the excellent type of Kintyre Clydesdale which exists at the present day. "Thompson's Black Horse," through the different Glancers and Broomfield Champion, seems to have been the really last horse of Dutch or semi-Dutch blood in which colour was made a particular of identity. Most of our modern Scottish draught-horse-breeders know that, so far as recorded history is concerned, he was the foundation sire of the modern Clydesdales. The Black Horse Wave passed off about 1828, when the colour was practically banned by the Highland and Agricultural Society, which singled out black bays and brown bays as the right horses to turn out for purely farming work.

Except in the Kintyre district of Argyllshire, which, strictly speaking, is not Highland, the Flemish influence held little sway. The horses which mostly went up into the mainland district of the Highlands were mostly greys. The latter colour lasted in favour in the north for many centuries. All the horses of the moss-troopers were bonnie greys or dapple greys. Burns's Tam O'Shanter rode a grey, and it was a grey which his Old Farmer saluted on a "New-Year's Morning." The moss-troopers and dalesmen rode greys, if their ballad-singers are to be believed. In the last decade of the eighteenth century Colonel Fullarton of Fullarton, on the threatened invasion of Napoleon, raised in Ayrshire a regiment of 200 farmers, all of whom were mounted on these old-time greys, which became known as the Glasgow Greys, largely from the fact that they embarked at Glasgow for service in Ireland, on the west coast of which Napoleon was expected to land.

Up till forty years ago grey mares of this ancient and undiluted Clydesdale type were quite commonly to be found stabled at all the country inns in Kilmarnock and Ayr on market-days,

hardy, useful, short-legged sorts, which might still have been preserved but for the fact that there were no grey stallions of their size, type, and activity available. Some of these old-fashioned gig-pony Clydesdale greys—the same greys which evoked the warm encomium of Napoleon at Waterloo—found their way into the north, and no doubt had much to do with forming the modern types of mainland Highland ponies. It is not perhaps, strictly speaking, "pony blood," but it was brought there when it was wanted, has done much good, and may do a lot of good yet if properly mated.

### *The Argyllshire (Mainland) and Western Perthshire Ponies (Glenorchy).*

Glenorchy, or, as it was in old times spelt, Glenorquhey, was for a long period of time a great centre of Highland pony-breeding. The peaceful river which gives the glen its name has its source in Loch Tulla, the beautiful little sheet of water opposite the Marquis of Breadalbane's lodge at Blackmount. In its course of eighteen miles to Loch Awe it drains what may yet be classed as a fairly mountainous country, the upper parts of which in recent times has become noted as a deer forest. Writing of the great snowstorm of 1554, the chronicler of Finlarig, the ancient monastic institution on Loch Tayside, round which were buried the Campbells of Breadalbane, says: "There was no thaw till 17th January. It was the greatest snowstorm that was seen in memory of man living. Many wyld horses and mares, kye, sheep, and goats perished and died for want of food in the mountains and other parts" These little "wyld horses" were no doubt the ponies indigenous to the district. Shortly after this period, if not before, attempts began to be made to improve them, as we find from the following letter from Lord David Murray, then Private Secretary to James I. of England and VI. of Scotland:—

To the Right Honourable the LAIRD OF GLENORQUHEY [GLENORCHY].

HONOURABLE SIR,—The Prince received a pair of Eagles very thankfullie and we hade good sport with thame and according to his promiss he hath sent you a horse to be a stallion, one of the best in his stable for that purpose and comendis him kyndlie to you and says that seven yeers hence when he comes to Scotland that he hopes to gett some of his breed. You shall excuse that he was so long of coming, for this is the first that he gave away since the time that ye was here and you know that I will be ever ready to serve you or to do you any pleasure that lyes in my power without any ceremonie and therefor I will not use many faire words with you for that is needless among frendis, but remember that I am a true Scotsman, unchangeable for all that I can see here and I think so to continue by God's Grace to my lyves end. Thus recommending you to the protection of God, I rest ever your loving freend to do you service

D. MURRAY.

WHYTEHALL, *9th January* 1609.

The Royal Mews then contained many varieties of horses—Spanish Barb, Arab, Turk, &c.—all of which were considered superior to our own as regards pace, style, and symmetry. Though no doubt a great deal of good was done by royal patronage of the character indicated, private enterprise was not lacking. Writing of the Thanes of Cawdor in his interesting work, 'Scotland during the Middle Ages,' Mr Cosmo Innes says: "Somewhat more care is shown of the breed of horses. Long before this time the lairds of Glenorchy had introduced English and foreign horses for their great stud in Perthshire, and the example was followed at Cawdor." So early as 1638 Duncan Campbell, writing from Isla to his brother Colin of Galcantray, says, "I wyshe if you may Cromarties old Spanish horse provyding he be of a reasonable prys."

The reputation of the Glenorchy stud, there is every reason to believe, extended into various other parts of the mainland as well as to the islands, and no doubt much of the character of the Highland pony, or rather what is left of it, came from out this great horse-breeding preserve. Everything seems to have been carried out in the most systematic manner possible, and no doubt some one had gone south to study the practical working of the various enactments made in England regarding the castration of all colts in the forests which did not attain to certain standards of height. At any rate, James V. imposed similar restrictions in the Scottish forest to those enacted a short time previously by Henry VIII. More than a full century afterwards we find, from the following entry in 'The Black Book of Taymount,' that the careful system of stud management still prevailed:—

John, Earl of Breadalbane, lets to John M'Nab for five years the grazing hills of Bentechie and Elraig, with the full accustomed places where his Lordship and his predecessors' horses were wont to pasture in Glenorchy, delivering to him thirty stud mares either with foal or having foals at their feet, the one-half worth 30 merks apiece, as also 100 merks Scots to buy a sufficient stallion not exceeding five years of age, to be kept with mares on the said grass; and the said John M'Nab is to keep the mares and stallion on his own peril, and to be answerable for them in all cases, excepting only the case of daylight depredations and public harrying in a hostile manner, and to keep the stallion from labour. To pay the Earl the sum of ten pounds Scots for each of the lands yearly in name of tack duty, and at the expiry of his tack to re-deliver to the Earl the same number of mares and foals and a stallion of equal value with these he received, or to pay the foresaid prices for the mares and the stallions which are awanting. And in like manner ten pounds for every foal which shall be short of the number of thirty as above mentioned, delivering also the Earl's burning-iron, which he received for marking the horses.

FINLARIG, 11*th June* 1702.

## *The Atholl Ponies.*

Undoubtedly the Atholl ponies have a very ancient history, though the early portion of it has not been recorded. In 1540 Henry VIII. sent to the Scottish king, whose favourite hunting and hawking quarters were the Forest of Atholl, under Sir Ralph Sadler, ambassador, a number of Spanish jennets and Barbary horses, which were evidently intended for breeding purposes. James IV. had previously introduced into Scotland several Spanish stallions. Louis XII. presented the ill-fated monarch of Flodden with twelve of his choicest French horses, no doubt the grey horses of Normandy. Most likely breeding operations in Atholl were seriously disturbed, as in Glenorchy, by operations—during the rebellions of 1715—which, as readers of Scott's novel 'The Legend of Montrose' are aware, were chiefly conducted in this part of the country. Still the old strains were never seemingly allowed to die out, though mayhap changes of blood were introduced from time to time. We have exceedingly pleasant mention of these ponies, some of which were models for Landseer's pictures, in our late Queen Victoria's 'Life in the Highlands.' Writing on 18th September in 1842, when at Blair Castle, the guest of the Duke of Atholl, her Majesty says: "We set off on ponies to go up one of the hills, Albert riding the dun pony and I the grey, attended only by Sandy M'Ara in his Highland dress. We went out by the back way across the ford, Sandy leading my pony and Albert following closely, the water reaching above Sandy's knees."

On the occasion of the King's visit to Edinburgh in May 1903, we had, on the invitation of the Marquis of Tullibardine, the pleasure of going over the representatives of the Atholl stud, as in their military capacity they were in Edinburgh acting as mounts for members of the detachment of the Scottish Horse. Four were greys, one a stylish mare, winner of a first prize at Ballinluig Show, almost white, one a dun, one a dapple-brown, and one a chestnut. The dun mare, with eel-back stripe, bred by Mr M'Millan of Calvine, had much true Highland pony character, and has won leading honours wherever shown. The greys were the more interesting, having been bred at Blair for many generations. A most notable representative was the Duke of Atholl's favourite hill pony, "Tommy," now going on for thirteen years. He has great powerful loins and quarters—in fact, is a miniature dray-horse, to which a sixteen stag would be but a feather-weight. The annual daily hill journey at Forest Lodge, we were assured, is rarely under thirty miles. The white mare, scarcely so powerful as

Tommy, is of the same build and shape. Since the formation of his regiment Lord Tullibardine has taken the greatest interest in everything pertaining to the Atholl stud, and has been good enough to supply us with the following notes, also the pedigree of that noted sire Herd Laddie:—

With regard to the Atholl stallions, the earliest one I have a record of was a piebald. No record exists as to the sire of Morelle, which was foaled in 1853 and described as a true garron.[1] Morelle was destroyed in 1872, having had one colt foal in 1871. The first stallion of the recorded stud was Glentilt, foaled in 1862, colour grey. He was bought from Donald Cameron, Glengarry, Inverness, for £13, 10s., and sold to the Earl of Southesk in 1869 for £60. He was the sire of several of our best hill ponies, notably Lady Jean in 1867, afterwards used as a brood mare. Her dam was Polly, a garron mare bought from Mr Halford, the tenant of Foss, who bought her in Muir of Orde market. In 1868 Polly produced to Glentilt the dun colt Glengarry I. This colt was kept as a stallion, and was the sire of many good animals, being sold in 1879 to Mr J. C. Cameron of Garrows, Glenquaich. Glengarry II. was our next stallion. He was by Glengarry I. out of a garron mare bought at Inner Hadden, Rannoch. The next stallion was Herd Laddie, foaled in 1881, the pedigree of which I append. He has been the most successful stallion we have had, and is still going. We have a young one coming on after next year called Bonnie Laddie, which is by Herd Laddie out of Minnette.[2] Minnette is the best brood mare that ever formed one of the Atholl stud, and is by Glengarry II. out of Minnie. Minnie was a yellow dun, foaled in 1861, by a cream-coloured garron, name unknown. Bonnie Laddie (of which a portrait will be found in this volume in the report of the Perth Show) is an ordinary dun, and bids fair to be the best-looking stallion we have ever had.

PEDIGREE TREE OF HERD LADDIE.

Prince. — M'Arthur's Maggie. | Stewart Prince — Cameron's Maggie.

M'Neil's (Canna). — Bella. | Campbell Lofty. — Miss Rankin.

Highland Laddie. — Jeannie

HERD LADDIE.

[1] Though the word "garron" has in recent years been used as descriptive of the heavy mainland types of ponies, its real meaning is gelding, and in the early premium lists of the Highland and Agricultural Society it was so applied, there being separate classes for stallions and mares.

[2] Since the above was written Bonnie Laddie has proved himself the outstanding winner in the pony section of the Highland Show at Perth in 1904, as will be found on reference to our report elsewhere.

## *The Ponies of Inverness-shire (Mainland).*[1]

Though Badenoch, as represented by Gaick, may be said to hold the best representatives of the Inverness-shire ponies, Lochaber seems really to have been the ancient headquarters. There was much communication between the islands and the mainland at Fort William before and after the great chain of lochs was joined together and formed into the Royal Caledonian Canal, and most likely considerable commingling of the different breeds of ponies. On the islands, as we have seen, there were more horses and cattle on the hoof than there was pasture to maintain them to profitable advantage, and if a pony could be sold or bartered for some commodity in which the islanders were not too rich, it was shipped with the small black cattle much after the manner in which Lord Middleton describes how his Applecross ponies are sent south by railway-truck to Birdsall, York, at the present day.

After the canal was opened up there was increased communication between the east and west of the Scottish Highlands: extra power was wanted on the towing-path, and Clydesdales and other varieties of southern horses sprung into demand. When the actual work of completing the canal was finished, a number of mares, as was the case at the completion of all the northern railway contracts, found their way into the hands of the local farmers. To keep up the strength and weight of the mares sires had to be brought north, and the owners of these, just as is much the case at present, took all they could possibly get in service-fees, giving small regard to what the progeny might be like, or, if there was no contingency as to the production of a foal, whether there might be progeny at all.

Some of the small farmers kept their colt foals by Clydes-

[1] The following from 'The Scotsman' regarding the Highland and Agricultural Society's meeting in 1869 may be interesting. The valuable Coulmore blood, it will be seen, was then well to the fore:—

"HIGHLAND PONIES.

"*Awards.*—Pony stallion not exceeding 14 hands. 1. Duke of Atholl (Glentilt). 2. Christopher Hope, The Heuk, Lockerbie; 3. Donald Macleod, Coulmore, Inverness-shire; *com.* Angus M'Allister of Daviot.

"Ponies (mares not exceeding 14 hands): 1. Jno. Baillie, Leys, Inverness; 2. Fountain Walter of Foyers, Muirtown; 3. Hugh M'Kenzie; *com.* Sir Dudley Coutts Marjoribanks."

Commenting on the awards, 'The Scotsman' reporter says the 1st prize stallion, the Duke of Atholl's, was a dark grey aged 3 years and 2 months, short and set wide; 2nd prize, an under-sized thoroughbred with superior action; 3rd, a bay Highland pony. 1st prize mare (Mr Baillie's), stout and handsome with good action, showing much of the Western Islands character; 2nd, light, but lengthy in front of the saddle, with handsome head. Sir D. Marjoribanks' cream-coloured "too near a horse to be included in the prize-list."

dales entire, and these in course of time were put to the old sorts of genuine Highland mares, and latterly the cross-bred fillies. Had a few of the old pure-bred colts been kept as stallions the process of mongrelisation might not have been so rapid or so complete; but the *big* stallions got all the patronage, and so the pure-bred pony colts were castrated. A few old studs were preserved, notably that of Corriechuille, for which we are indebted for the modern Gaick strains of blood now being extensively used by Professor Cossar Ewart and Lord Arthur Cecil.

As Achnacarry has a very ancient reputation in connection with deer-hounds, ponies, and everything connected with the work of the forest, we think it well to reproduce some notes kindly supplied to us by The Lochiel, who writes:—

There never has been any special breed of ponies in this quarter, and until the last two years no one thought of improving them. Since the formation of Lovat's Scouts some impetus has been given to raising a class of animal suitable for military as well as sporting purposes, but of course this requires time.

The farmers mostly used to breed or buy half ponies, half Clydesdales; so also the crofters, except that those used by the latter were not as a rule so heavy, though some of them did well enough as hill ponies. For myself, I have never been without a real good pony or two bought in the district. I have two now—one thirty years old, a fast trotter, and the best hill pony I ever rode; the other also smart enough to drive in London, and which we use here in a pony carriage or on the road (riding). You cannot find a better beast in the shooting season to carry panniers, or to carry myself, on steep, rough, or boggy ground. But these kinds of ponies are rare. In old days there was another class about this country, whether bred or bought elsewhere I cannot say. The stamp was small and with light bone,—not the best of shoulders, but extraordinary good ribs and back, with very powerful quarters, about 13 hands high. Such a pony I once had, and it lived till close on thirty years old. This particular animal was rather a slug and not very good trotting on the road, but wonderfully good with a deer on its back. No weight seemed too heavy, no ground too steep or soft. Another of the same stamp in my younger days was owned by an old Highland drover, who had the farm of Enacht on this estate. This man must have weighed 16 or 17 stone, and he rode the pony all the way to Falkirk and attended every market. His legs seemed to be only a few inches from the ground, so tall was he and so stout his mount.

The ponies of the present day, though wanting the character and endurance of those described above, seem to produce a useful class of animal when mated with any kind of well-bred sire, whether Arab, polo pony, roadster with action, or *so-called* Highland. The only cross I dislike extremely is the ordinary English thoroughbred horse, which in my experience produces a weedy brute with long legs and no action, useless on the road and dangerous on the hill. The bad points of each parent seem to be reproduced and none of the good ones.

Readers of 'Rob Roy' may be reminded by the above of the description which Scott gives of the somewhat ridiculous figures Bailie Nicol Jarvie, after his "sair tribulations," and Francis

Osbaldistone cut, with their feet almost touching the ground on their homeward journey from the Trossach country down to Balloch at the foot of Loch Lomond. No doubt the Great Wizard drew the picture from his own experiences early in the commencement of the past century. Wordsworth, who must have been accustomed to riding little Fell steeds in his native Lake county, did his celebrated Tour in just such an equestrian fashion. The small ponies of Inverness-shire no doubt disappeared before the craze for size and the very determined efforts of the Excise to put down smuggling, the little pony with its two kegs slung across its back being all the form of

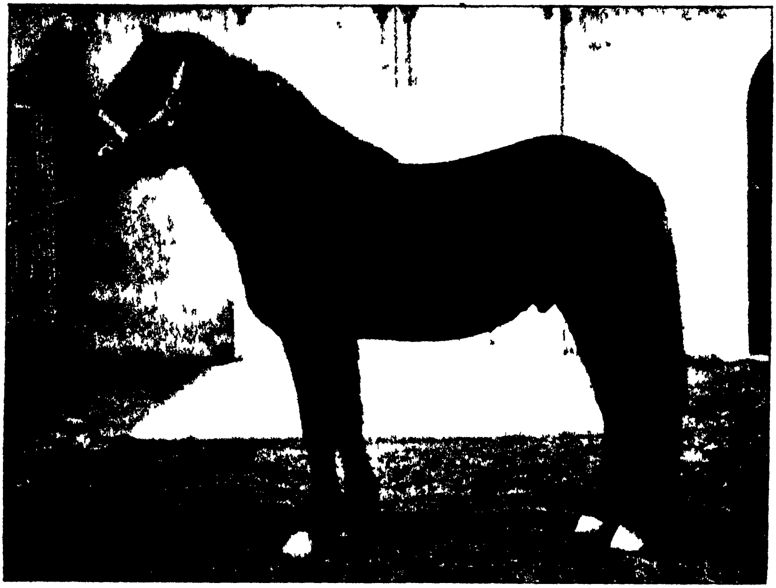


Fig. 1.—*Highland pony colt 'Atholl.'*

"permit" which those engaged in illicit distilling thought necessary in taking their productions from the more favoured barley-growing districts of the eastern mainland across to the west country.

*The Gaick Ponies.*

Sometime previous to 1833 there existed at Corriechuille, in the Lochaber district, a noted stud of Highland ponies. They were of all colours—browns, bays, greys, duns, yellow-creams, and piebalds. The late Mr William M'Kenzie on the Gaick forest bought some of the best of these and took them east into

the Badenoch country. Gaick, though not a royal forest, is one of the oldest on the list, and was never in the modern sense afforested—*i.e.*, cleared of sheep for the purpose of making room for deer. So far back as 16th July 1691 we find the Duchess of Gordon writing to Viscount Tarbert, who then held high position at Court, complaining of the abuses of the military detachment then stationed in Badenoch. In concluding her letter her Grace particularly complains of Captain Hugh M'Kay and his men "as becoming exceedingly troublesome, not only by their several operations in other things but particularly by their wasting the forests, and especially that of Gaick being near them. They are so imperious that the forester dare not find fault with the doers." In modern days Gaick has taken a high position in the deer-stalking world.

In regard to the Gaick ponies, Mr Edward Ormiston, head forester, tells us that the most noted mare at Gaick for a long time has been Gaick Calliag. This grand old type of a Lochaber pony, when sixteen years old and carrying her ninth foal, was secured by Lord Arthur Cecil for £64, and passed into the New Forest. At the same time her own son was sold for £75 to Mr Forsyth of Quinish for the Congested Districts Board, and was forwarded to The Bungalow, Penicuik, where he was renamed Atholl (fig. 1), and of him full particulars will be found in our notice of Professor Cossar Ewart's experimental operations. The sire of Atholl was Herd Laddie, bred by Mr Donald M'Kenzie, Ballachulish, and the extended pedigree of which will be found in Lord Tullibardine's notes on the Atholl stud. As bearing much on present Highland pony-breeding, we give *in extenso* the pedigree, with particulars, as supplied by Lord A. Cecil:—

Gaick Calliag, black, mare; foaled 1886; 14 2 hands high; weighed 13¾ cwt. off grass, Dec. 2, 1902. Has a curious splatch of white on inside of hock, attributed by Mr Ormiston to harking back to the old Lochaber piebald mares.

Dam, Gaick Sally; sire, Glentilt by Glengarry I. (see Atholl pedigrees).

G. dam, Old Sally by pure Highland horse; bred by Mr M'Pherson, Ethridge.

G.-g. dam, Granny; bred at Gaick by the late Mr M'Kenzie.

Mr Ormiston, though he has parted with Calliag, still retains at Gaick two daughters, Polly and Tibby, with a filly by the latter to Moss Crop. He has also got back Mountain Polly by Herd Laddie out of Gaick Calliag, and which won second prize at Perth last year (1904). Another mare he prizes much is Morag, a dun by Gaick Laddie, a son of Calliag, and which takes after the grand-dam in size, stamp, and weight. Last year she dropped a grand colt foal, yellow with black points and eel-back stripe, which he has named Highland Stamp. Tibby, Polly, and Mountain Polly were served last year by Moss Crop, and Morag by Herd Laddie. Hardiness is one of the strong features of the Gaick ponies, and Calliag, till she went south, never was under roof winter or summer. The

ponies are left out all winter, but the foals are taken in after New Year's Day till the mares are dry of milk. They are let out during the day but taken in at night till May. They are never under a roof after that again till three years old. When three years old they are broken to different forms of harness work, dog-cart or van, and they do all the carting. "When they are tractable in harness," says Mr Ormiston, "I send them to the hill to carry home deer. If the first stags are tied firmly on their backs they soon go as quiet with deer as with anything else. They generally have to take a stag 17 stone weight home over seven miles of bad road, through moss and down very steep faces. We cart coals and everything here with the ponies. We have fifteen miles of bad road from the station, and their load is always half a ton. When carting they are hand-fed." It may be added that Mr Ormiston finds Gaick ponies equal in hardiness during a severe winter to cattle, sheep, or even red-deer.

### *Guisachan, Glenquoich, Mamore, Corrour, Glengarry, and Aldourie Ponies.*

A stud which has taken special pre-eminence in the show-ring during late years is that of the Marquis of Tweedmouth at Guisachan, Beauly, Inverness-shire. The afforested ground, which covers 16,000 acres of the picturesque vale of South Affric, requires a number of useful ponies every season for hill work. Early in the Seventies the stud was formed by mares selected in Mull, Skye, and other of the Western Islands. These mares were served by a black pony stallion owned by Mr Macleod of Coulmore, in Skye (see Applecross and Orchardmains articles). With a view to getting more quality and style (as has done Lord Middleton at Applecross) the late Lord Tweedmouth brought in Kit, a son of Mr Christopher Wilson's famous show-yard champion Sir George. Sir George was bred by Mr Wilson at his place Rigmaden Park, Kirby-Lonsdale.

The Fell ponies are no doubt of the same Norse character as those of the Outer Hebrides, the whole district of the Land of Lowthers, in the centre of which is the Priory of Lanercost, having for centuries been under Danish rule. They are all mostly browns and black-browns, ranging from 13·0 to 13·2, and run wild, galloping freely up and down hill, and know no housing. The Yorkshire Fell ponies (*vide* Mr Wilson's letter—Applecross Stud) are half a hand higher on the average.

A number of the best of these mares Mr Wilson in 1872 put to Sir George, a Yorkshire hackney by Sportsman (796, H. S. B.), by Prickwillow, descended through Phenomenon from the original Marshland Shales, the Eclipse of hackney horse-breeding. Mr Wilson mated the filly progeny to the sires, thus by in-breeding securing the hackney stamp and action. Size, however, had to be kept down, and the second batch of progeny were turned out on to the hill, where short rations and a rigorous climate kept them under 14 hands. In the end there was produced George

5th, the Sir George alluded to. This stallion was invincible, and he and his progeny won all the gold medals of the Royal Agricultural Society at the Jubilee Show at Windsor.

After a lapse of a few years (1896), Lord Tweedmouth introduced into the stud two exceedingly well-bred English pony stallions—Seaham by Lord Derby II., and Guisachan Miracle by the famous Little Wonder II. One crop of foals was taken from the former, and then Miracle was installed as stud-horse. That pony-breeding on these lines has been made successful at Guisachan may be noted from the fact that at the draft sale in March 1903 a pair sold at 130 guineas, a single pony at 68 guineas, and others as high as 50 guineas. Notwithstanding this, and the fact that Lord Tweedmouth has supplied the crofters of the district with the services of a pony stallion at nominal rates, they still prefer to use small mongrelised Clydesdales.

In regard to the hill ponies in the forests of Glenquoich (Lord Burton), Mr George Malcolm says:—

> There are nine or ten good hill ponies kept, though nothing special has yet been done for the breeding of such. They have all been bought in, and present no special features except that they are very serviceable and sagacious, and most of them used to carrying heavy weights to the tops of steep and rather high hills. They are usually kept out till this period of the year (January). During the spring months they are taken in for the night or are put under cover of open sheds, but are usually turned out for part of every day that is not too stormy. They have during these spring months some extra feeding, of course, which is of the usual kind—oats, hay, &c. These ponies, which belong to Lord Burton, are used by his lordship and his guests, but a large number of other ponies are hired from crofters and keepers for the carrying of deer from the hill to the lodge, &c.
>
> The hire of a hill pony alone is at Glenquoich 3s. per day, or if the owner is along with it, 6s per day, and the gillies receive a luncheon every day to the value of 1s. 6d.
>
> It is very much to be regretted that the breeding of the old and handsome stamp of hill ponies has so much gone out. I have to pay a very long price for a hill pony when a really good one is required, and I have always thought that it would pay people who have facilities for it, such as sheep-farmers, to do some breeding of good hill ponies.
>
> During the shooting season, when grass is plentiful, these hill ponies do not get corn for food, except an occasional feed when they come in with a load late in the evening.

The foregoing remarks extend equally to Glengarry (Mrs Ellice), Corrour (Sir John Stirling Maxwell, Baronet), and Mamore (Frank Bibby, Esq.), which are all under Mr Malcolm's management.

At Aldourie Colonel Fraser-Tytler is using a handsome little Basuto stallion, Pom-Pom (fig. 2), which he rode for twelve months with the Lovat Scouts in the South African war. He is a grey, height 13·3 hands, girth 5 feet 5 inches, and measures

7½ inches below the knee. He is an extraordinary stout pony, fast, active, and a wonderful stayer. In two riding tours taken in Scotland he has been found to tire less than any other horse, and is so docile that the Colonel's children ride him. He shows the Arab in everything, as may be judged from his portrait.

*The Applecross Stud.*

Whether it be raising Shire horses, hunters, or crosses from the Arab, it is well known that Lord Middleton is not only most enthusiastic but practical. Operations in connection with

Fig 2 *Basuto pony stallion, "Pom Pom"*

the former are confined to his extensive estates at Birdsell, near York. At his lordship's deer-forest of Applecross in the Highlands he has a very grand and very pure stud of Highland ponies, regarding which he has been good enough to forward us the following particulars:—

The present Applecross stud of ponies was formed about the year 1878, though previous to that time my father, the eighth Lord Middleton, kept and bred ponies at Applecross. About that time he came into the possession of a grey mare, Kitty, which he bought with the property from the Duke of Leeds in 1861. This mare had been bred by the M'Kenzies of Applecross, who had ponies at the time on the place, which he brought from Skye.

The mare Kitty was a good type of the Highland pony. In 1878 I bought a bay mare in foal from Mr Macrae of Glenbaragait in Skye. He (Macrae of Glenvarait) was of the same family as the Macraes of Camsunary, near Cornisk, in the Isle of Skye. This mare was a beautiful type of the Highland pony, small, strong, full of mettle. At that time she was in foal to a pony which took first prize at the Highland and Agricultural Society's Show. She dropped a bay filly, and both go respectively now by the names of the Old Skye mare and the Young Skye mare. From these two mares many of my ponies have been bred.

In 1882 I bought a beautiful grey mare, Molly (foaled 1872 and 1873) at the sale of Lord Dacre's ponies at Garve, Lord Dacre having then given up his forest. She was his favourite hill pony. I bought another, which did not breed. This mare Molly was larger than the two Skye mares, about 14 hands, and strong. She had a family of three colts and two fillies to Glen. Glen's sire used to travel in Skye and was a chestnut with a white mane. The eldest colt, foaled in 1884, was a chestnut with silver mane and tail. I have ridden him for the last fifteen years, and have always taken him with me to Scotland. He is a wonderful pony, very strong up to 16 stone, can walk five miles an hour, is exceedingly wise and clever, and never makes a mistake. A sister (grey) was a carriage pony, and is breeding now. Another sister travels at Birdsall with the stallions. A brother goes in harness. The other colt I sold.

In regard to types and colours, all my ponies are thick-set, strong, short-legged, and bred especially for carrying weights (deer) and for riding on the hill. Their colours are black, chestnut, grey, and bay. The chestnut probably comes in from Glen, as I hold that chestnut and black are akin.

In the spring they plough, cart, and execute the general work of the foresters' crofts. In the autumn they of course do the work required of them in the forests. Some I use as carriage ponies, some also I use at Birdsall for going messages—post-office communication and the like—or travelling as groom's mounts with the Shire or Thoroughbred stallions. All are brought to Birdsall to be broken They usually arrive in a truck with the Highland cattle. They are then broken at The Hunter Stud Farm, and used for the different classes of work alluded to in order to make them quiet and tractable. Those required at Applecross are returned for work there.

Some I have successfully bred from here to the Arab stallion—beautiful hardy ponies, fit for polo or hacks, and I should think just the sort for mounted infantry. I have all through tried to keep up the Highland pony hardihood. Here (Birdsall) and at Applecross they only get hay or silage during the snow-times. Of course during the stalking season they get a feed of corn daily. Except those used for carriage purposes, they are never under cover, and the latter are only kept up during the period they are used for carriage work, being turned out for the winter.

The first sire used at Applecross was Glen, a black or brown, bred and owned by Mr M'Leod, Coulmore, in Skye. This Glen, the reader will perceive, is exactly of the same blood as Allan Kingsburgh, mentioned in Lord Arthur Cecil's notes about the Orchardmains stud. He was a strong thick pony, with capital feet and legs and good shoulders. Lord Middleton bought him in 1881. He died in 1888. The next stud-horse (still in use) was Fitzgeorge 4265 (H. S. B.), foaled in 1877, by Sir George (778), the famous Champion prize-winner of Mr Christopher W. Wilson of High Park, Kendal. Fitzgeorge's

dam was Fanny, a well-known Cumberland mountain mare out of Metal, and came of a noted Cumberland Fell stock. He was bought at the Islington Show in 1893. He is a grey, 14 hands, of great power and substance, with very good action. Borrodale, a grey, by Fitzgeorge, foaled in 1895, is a strong thick pony with good action, out of Morag, a wonderfully good, strong dun mare of a beautiful type, used for many years carrying deer and sportsmen. Morag's dam was by a dun pony from the old grey mare Kitty, her grand-dam the Old Skye mare. The dun pony was by Comet, a Welsh pony belonging to a Mr Bower, who rented Strathiard in Skye, and travelled him.

Of the seven mares being bred from at present, five are by Glen. That the Skye blood has always been particularly strong in the stud may be noted from the fact that Ruadh, chestnut with silver mane and tail, the Uist colours, foaled in 1883 by the Old Skye mare, has had three colts and fillies to Fitzgeorge, and that a bay mare by Glen, foaled in 1885, dam the Young Skye mare, has had to Fitzgeorge two colts and two fillies. All the produce, as all modern students of modern pony-breeding will see, represent as in the Guisachan stud combinations of a very old Highland strain of Island blood with Cumberland Fell through Fitzgeorge's dam. Sir George, of course, as has been noted, was a blend of Fell and Hackney. Molly II., a grey by Glen out of Lord Dacre's mare, has one colt and two fillies to Borrodale. A bay mare by Fitzgeorge out of a Glen mare is breeding successfully another, a black, to Borrodale, while a daughter of Ruadh and Fitzgeorge has had a filly foal to his lordship's Arab stallion which stands at Birdsall. A little hack mare (1884) by Glen, dam the Young Skye mare, has a filly to Borrodale. In regard to the breeding of the noted Sir George type of ponies, we cannot do better than quote the following from a letter of Mr Christopher W. Wilson, now of Rigmaden Park, Kirby-Lonsdale:—

The old Galloway was the same as the Fell pony, only showed a little more breeding. The Fell pony in my part of the country is from 14·1 to 14·2, and usually used for all kinds of farm work; in fact it is a miniature little cart cob. The Arab crosses will not stand the winter out of doors. I saw a lot of them in the Island of Harris, but they could not remain out in winter the same as the Fell pony. No doubt the Arab cross sweetens their heads, but they lose the bone and constitution. My Sir George ponies used to lie out all winter, and I only took them up about three weeks before sending them to the Islington Spring Show and winning with them.

I am quite sure the Hackney would be a much more suitable cross for the Fell pony to breed troopers from than the Arab. They would be much hardier. I don't mean the pampered-up hackney.

### *The Drumchorry Ponies.*

The Drumchorry stud of Mr Donald Stewart has of late made its mark in the Highland Society show-ring. The blood is mostly off the North Uist stock of the Macdonalds of Balranald, and directly traceable to Tom, the property of the late Mr Macdonald, which was first at Glasgow in 1882 and Inverness in 1883. Moss Crop, the gold medal winner at Dumfries in 1903, is a typical Highland stallion, short coupled, and with good substance and power. His dimensions are—height 14·2, below the knee 8½ inches, length 21 inches below the hock, width between legs 10½ inches. He was bred at Balranald and was got by Sollas, and is come of an old North Uist strain. He was first in his class at Aberdeen. At Drumchorry Mr Stewart has Heather (No. 252), also bred at Balranald. He was awarded a silver medal at Aberdeen. Highland Nancy, better known as "Donald Stewart's grey mare," bred by himself, is a grand representative of her sire, Herd Laddie. She is 14·1, is wide in front, very powerful, and has 7½ inches of bone under the knee. Darling, Mountain Maid, and Mountain Polly are also nice mares at Drumchorry. Mr Stewart had the stud at Glenloy, six miles from Achnacarry, the only stud of note in that district since Corrychoile's time, and in which was conserved a good deal of the old blood which has been found so useful at Gaick. All good pure strains from time to time were drawn upon, including those of Athole through Glengarry and Herd Laddie. Mr Morgan of Dunblane, who accompanied Mr Stewart to Uist, is still alive and has pleasant memories of his visit to Balranald, where they found the colts harrowing-in the old wild oats, "as rough as the oats themselves, and you could hang the latter by their beards on your hand." The same stock had been on the place at Balranald as long as man could remember, and one old horse then at work in the harrows was thirty-two years old. Heather was bought on the occasion of that visit, and Moss Crop was afterwards sent for. The Drumchorry mares have been handed down from father to son for many generations, but it is generally thought that they originally came out of the Kirkmichael district. Highland Nancy had a colt foal in 1903 and a filly foal in 1904 to Moss Crop, who served 80 mares of all sizes from 12 to 16·2 hands in Inverness-shire and Perthshire, and almost as many in 1904 in Inverness, Perthshire, and Forfarshire.

### *The Ponies of the Inner and Outer Hebrides.*

In dealing generally with the ponies of the Western Islands of Scotland one has to consider very carefully the means and

difficulties of communication with the mainland. There was, of course, much inter-trading during the periods when wind, weather, and sea permitted. For a long time there has prevailed a tradition that the general excellences of most of our Highland ponies were entirely attributable to the latter-day misfortunes of the Spanish Armada. Without the story of the unfortunate Armada we would be quite willing to accept the idea that Spanish blood, which of course was Asiatic blood, in some form or other found its way on to these island shores. Spain was the great maritime nation, and before Columbus discovered America (1492) its mariners pushed trade in every form and in every direction.

As subsequently mentioned (see Argyllshire and Glenorchy Ponies), Spanish stallions were evidently sought after before and after the Armada period. Though more than one breed of cattle and horses have had their excellences traced to some connection with the flotsam of these ill-fated ships, giving all respect to the modicum of truth which is attachable to tradition, we do not think that such foundatory theories would bear crucial examination. Climate, soil, and the systematic introduction of blood calculated to be superior, have with skill and judgment been responsible for all that is excellent in our British horses at the present day

The Armada theory, however, falls to be dealt with, more particularly so when the Mull ponies are under review No doubt exists whatever as to a large ship having been blown up in Tobermory harbour, but it is not so easy to accept the statement that the Spanish horses swam ashore and were the means of improving the native breed. In the 'Harleian Miscellany' we find from the evidence of the surviving Spanish sailors that such horses as were carried were thrown overboard long before the scattered fleet had got through the Pentland Firth. The evidence of John le Comdo—and he is not alone—is very particular as to this. "He was in the Admiral's ship, he saith; after the Spanish fleet parted with the English fleet they cast out all the horses and mules into the sea to save the water which was carried in certain hulks for that purpose." There may possibly be some little truth in it, but, independent of this, small doubt whatever exists but that Spanish blood was at an early period introduced into the Western Islands. As to the Outer Hebridean islands, they seem to have belonged to the old Norse stock, as did the M'Neills of Canna and other islanders themselves. The white-maned breed of Uist is the same as is to be found in the Faroe Islands and elsewhere, these markings being very general amongst northern ponies. The Uist, Barra, and Hebridean ponies generally are dealt with in the article on Professor Cossar Ewart's experiments.

Mr Macdonald of Balranald says that the old dun breed are the most prized, but that they have been getting very scarce of late.

*The Isle of Mull Ponies and Isle of Skye Ponies.*

If the reputation of the old Mull pony was not quite so ancient as that of the Galloway, it was at one period almost as great. Possibly when the dealers found the stocks of the latter somewhat thinned or impured by crossing they bent their steps further northward. Intercourse between England and Scotland was getting greater every year, and the drove-roads leading southward by Lanark, Dumfries, and Carlisle through Westmoreland at the close of Falkirk Autumn Tryst were thronged with black cattle. Many of the masters accompanied these droves for certain distances, as cattle-thieving was so common that a special staff of Bow Street runners had to be employed for self-protection. Just as the southern graziers used Yorkshire or Norfolk hackneys for their work, which required many long and rapid journeys from market to market, the northern men rode their own hardy hill ponies, which, though endowed with less pace perhaps, were always sure-footed, hardy, and reliable. Though it was as a saddle-roadster that the merits of the Mull ponies were first recognised, they grew into importance as a useful type for the petty classes of collective and distributive work developed by our railways. They were always saleable to go south, and being regularly inquired after, the northern dealers or their representatives regularly attended Salen Fair. The Scottish contractors also needed large numbers for their own parcel-cart work, and outside of this butchers, bakers, and small tradesmen generally were asking after something hardy and active, and which they might trust to stand still at the door of a customer.

Mares which might have proved useful for reproduction were sold with possibly a year's work in them when four years old at very much the same prices which were asked for geldings, and so the old stock gradually became depleted. The mischief was not allowed to end there, for Clydesdales, Roadsters, and other types of stallions peculiar to the Lowlands were taken in without much regard to what the subsequent results might prove. The cross-stallions from these being kept entire, the work of mongrelisation was gradually extended. Still, a few stuck to the old sorts and used an old-fashioned Mull sire when opportunity offered. We have through this some strains of the old Mull blood in which to set to work. The actual Mull pony which made the market may not be got back, but we have something like it which can reproduce itself, and know that matters ought to be trending in a useful direction.

Having regard to the fact that the Mull ponies must have earned many of their best points and characteristics from Arab or other pure or modified form of Asiatic blood, Mr J. H. Munro Mackenzie of Calgary, who is somewhat of an enthusiast in Highland pony-breeding, has been going back into what might be called the prehistoric period so far as the Hebrides are concerned. Disappointed like many others with the thoroughbred, or that form of it which generally finds its way, as we have shown, into the regions north of the zone of racing, he brought with him from Algiers a useful type of Arab stallion, which he had there used as a hack. The stock of Syrian, as this horse is called, on Clydesdales was, as might have been expected, unsuccessful, and his owner set himself to pick out something closer akin, as to type at least, in the existing Island mares. When writing on the subject, we had the following communication from Mr Mackenzie:—

I think Fraccado (134), dam the Langa Mull mare, was quite one of the old heavy kind that would do all the work on a small farm, and her sire, the Kinghan pony, was just quite such another. He was bred by the late John Maclean of Kinghan. After serving some time in Mull he went to Canna, and was there bought by the late Mr Lang. Mr Lang sold him to Mr George Robb of the Caledonian Railway Company, who worked him in a little van till death. I often wanted to buy him back, but still time went on and the old pony died. Molly (134) is out of a good Mull pony off an old kind my late tenant Mr Thorburn used to have. All of them were dun with black stripes down the back and markings on the legs. She was a "chance get" by some pony running on the hills. The Mist (1319) was bred on the Ross of Mull, and said to be pure Mull. She is no doubt a fine type of the strong Highland pony fit for farm work, but she looks to me much liker the old Glengarry pony, and it is quite possible she has a strain of his blood, as a son of his was in Mull sixteen years ago. As yet I have not been able (April 1903) to trace out or identify this strain.

The line I am going on is to try to get better backs and shoulders on the Highland ponies. I like the Clydesdale as much as any man, but the cross was not a success: the land and keep here are too poor for Clydesdales. I am crossing Highland mares with the Syrian, a well-bred and very good type of Arab. I am putting the fillies of this cross back to Islesman (see pedigree, showyard successes, and portrait). Putting Syrian (the Arab) to very small ponies, 12.2 to 13.0, I got them too small; but putting him to the strong Highland mares about 14.2, I have had some grand ponies, and all I have sold have averaged over £40 each. I am quite sure the Arab blood made the Mull ponies what they were in old times, and I do not see why we should not go back to it again.

An excellent representative of the modern Mull pony is Islesman (253, Polo Pony Stud-Book) (fig. 3), first-prize winner at the Highland and Agricultural Society's Show at Dumfries in 1903. He has plenty of bone, good joints and feet, and possesses pleasing shapes. His sire, Benbecula, was a Uist pony, his dam, Molly (third in the Highland Brood Mare class, Polo and Riding Pony Show, London, last year), a Highland black mare by

believes, if the Arab is to be introduced for improving purposes, in the *Indian* Arab, which is able to confer much bone and substance, and thinks that the most useful of such sires could be bought cheaply in Bombay. An excellent type of an Indian-Arab pony stallion was exhibited as extra stock at the Edinburgh Agricultural Exhibition in 1903. He is the property of Mr G. Alexander, Cockburn Hill, Balerno, and has been successfully used as a sire in Perthshire to pony mares.

In the meantime it is satisfactory to note from the Orchardmains, Guisachan, and Applecross pedigrees that we have still a good deal left of the old Skye blood so long preserved by the Macleods of Coulmore.

The following letter from Mr Garrioch, factor on the Lovat estates, throws light on this old Skye blood as well as on Guisachan, Applecross, and Orchardmains pedigrees:—

BEAULY ESTATES OFFICE, BEAULY.

DEAR SIR,—Lord Lovat has handed to me your letter of the 21st ult. regarding the garron pony stallion Allan Kingsburgh, and I have now seen the coachman, who informs me that his lordship's grandfather had the pony (a dark bay) for twenty-eight years He bought him from Mr Macleod, Kingsburgh, Skye, and got his pedigree, which was an excellent one, but it is not known where it is now. Lord Lovat was in the way of sending mares to this horse to Skye before buying him, and when he heard that Mr Macleod was about to castrate him he bought him and informed the present coachman at Beaufort that Allan Kingsburgh was the purest bred Highland pony in Skye. After he came here Mr Macleod used to send mares to him, and sent one as often as five seasons. He left nearly a hundred foals Lord Lovat gave all the crofters the service of the horse free. There is still one of his numerous progeny at Beaufort, a mare about twenty-eight years old She has had six foals, but not one of them is here The coachman thinks the horse was bought about thirty-five years ago. He was shot at Beaufort nine years ago (1895), when he must have been about thirty years old. The coachman says a grandson of Allan Kingsburgh travelled Inverness-shire for two seasons about six years ago. He was a black pony and belonged to Mr Macleod, Coulmore, Antafallie, Kessock, Inverness. Mr Macleod is now, I understand, in America.

*The Isle of Rum Ponies.*

Though the ponies of the Isle of Rum owe much of their modern reputation to the enthusiasm of Lord Arthur Cecil, and the fact that a Rum pony mare was used by Professor Cossar Ewart in carrying out his experiments with a zebra sire, they seemed to have possessed characteristics of a most pronounced and valuable character for close upon two centuries. About the second-decade of the eighteenth century (1712) Clanranald introduced Eastern stallions from the mainland, and these no doubt gave them symmetry and quality, features not too pronounced in any of these island ponies, or the Norwegians which the Vikings brought round Cape Wrath with them in their

galleys. Dr Johnson, who with Boswell was the guest of Mr Maclean, the then proprietor of the Isle of Coll, has the following entry regarding Rum ponies in his 'Tour in the Hebrides':—

> The horses are very small, but of a breed eminent for beauty. Coll not long ago bought one of them from a tenant, who told him that as he was of a shape uncommonly elegant he could not sell him but at a high price, but that whoever had him should pay a guinea and a half There are said to be in Barra a race of horses yet smaller, of which the highest is not above 36 inches.

It would thus seem that the breed had a special value for improving purposes in the eyes of the natives of the other Hebridean Islands. The remoteness of Rum, like Barra and the Uists, kept the breed uncontaminated by mainland crosses, of which the latter were chiefly combinations of small old-type Clydesdales and coach-horses, save, as we have noticed, in the Glenorchy and other royal forests. If fresh blood found its way by times into Rum, most likely it would be from Tiree, Mull, or Skye. Up till fifty years ago they were still conspicuous for their shapes and style, and they have steadily been conserved from within. Lord Arthur Cecil has very kindly given us a sketch of his Highland stud, and as it practically is the modern history of the Rum pony, we give it in his lordship's own words.—

> In 1862 I remember nine very good black ponies coming to Hatfield, which were said to have been running quite wild in the Island of Rum. They were all too wild to be broken but two, which my brother (the late Lord Lionel Cecil) and I succeeded in getting quiet enough for us to ride and drive, though they were never a very safe conveyance As long as they were allowed to go their own pace up-hill and down-hill (about twelve to thirteen miles an hour) they were all right, but they could not be checked or steadied. We hunted and drove them till they were twenty-eight or twenty-nine years old. I overheard my father telling Lord Cowley, the Duke of Wellington, and some others that they showed so much Eastern blood, when he visited the island in 1847, that as he was returning home from Rum he bought a horse for £5 that he saw kick a cab to pieces in front of his hotel in Glasgow. I *thought* he called it thoroughbred, but I was only eleven years old, and he may easily have said *pure bred* (probably Highland), because I came across the son of a man, Macleod of Coulmore, who sold a horse called Lord Ronald to my father to turn down in Rum. My father also turned a Spanish jackass out on the island and bred some magnificent mules, which were working in the garden carts far on into the 'Seventies.
>
> In 1888, when Rum came to be sold to Mr Bullough, now Sir George Bullough, I bought eight of the ponies—Iona, Muck, Rum, Staffa, Eigg (a young stallion afterwards cut), Bagsy, Yolk, and Hebridean (a stallion) —and continued the breed; and when again in want of a stallion I remembered in 1884 or 1885 seeing a stallion and two mares shown at the Highland and Agricultural Society's Show. These were all bred by the same man, Mr M'Leod of Coulmore. I bought the stallion, Highland Laddie, under the nose of a man who had come all the way from Australia

after him, just securing him by ten minutes. I then set to work to find out how he was bred.

I traced Mr M'Leod from Australia to New York, and then found out that the horse was of the same breed as the stallions used many years ago at Applecross and Guisachan, all being got by Allan Kingsburgh out of a very noted mare, Polly. Allan Kingsburgh was sold to Lord Lovat, the grandfather of the present peer, but only on the understanding that Mr M'Leod should have free use of his services, and with him and also with Polly Mr M'Leod bred eight, all of them noted ponies. In his letter telling me this he asked me if I was any relation to the Lord Salisbury who bought a horse called Lord Ronald of the same breed and sent him to

Fig. 4.—*Highland pony stallion, "Highland Laddie."*

Rum. He described this pony as a mouse-dun with an eel back. The story was told of Allan Kingsburgh that he swam a loch with a deer on his back.

. . . . . . . . . . .

Highland Laddie (fig. 4) was identical with the Rum ponies in appearance and type. Having been through all the Outer Islands, I am quite certain that the Rum ponies are of the improved type of Uist ponies, as well as many of the more remote mainland ponies.

I also used for my Rum mares (though I never kept any mares for breeding from him) a very good pony, Marmion, by Mars out of a mare by The Yankee [see Mull pedigrees], who was greatly used for Highland mares. This mare's mother, again, was by an Arab belonging to Poltal-

loch out of a very favourite deer-stalking pony, Marmion, and was the most extraordinarily impressive sire I ever saw, but he entirely lost the Highland type.

It may be interesting to know that nearly all the stallions of his Rum breed Lord Arthur Cecil has used with marked success in the New Forest. They contribute hardiness to the Hampshire stock, which are bred in a much softer climate. A stallion by Hebridean out of a Fetlar mare his lordship recently presented to the Congested Districts Board (a Rum, Fetlar, and Barra combination, all island blood) for use in Barra.

Fig. 5.—*Highland pony mare, "Duchess."*

The Barra people are, however, beginning to have a craving for size. During the past year the Orchardmains stud, now so large and various, has been enlarged by six mares of the mainland or so-called *garron* type — two silver-maned ones from Uist, two mouse-coloured duns, and two blacks, Calliag and Duchess (fig. 5), the latter being the first at the Highland and Agricultural Society's Show at Dumfries, and winner of the Champion Cup for mountain and moorland ponies at Islington, 1904. Belle, an Atholl grey Highland Laddie mare, is now (1894) at The Bungalow. Jim-Jam's pedigree we give as follows. Hebridean's father was washed over the cliffs of Rum in 1877 (fig. 6).

PEDIGREE TREE OF JIM-JAMS.

| | | | |
|---|---|---|---|
| Alan Kingsburgh, bred by M'Leod, Coulmore, Skye. | Polly, bred by M'Leod, Coulmore, Skye | Hebridean, bred wild on Rum, black. | Staffa, bred wild on Rum. The true brown, with mealy nose and belly so often seen in native ponies of all breeds. |

| | |
|---|---|
| Highland Laddie, black. | Rum, black |

JIM-JAMS,
bred by Lord Arthur Cecil,
black mare, Rum breed,
born 1891.

*Professor Cossar Ewart's Experiments at The Bungalow.*

In writing on Highland ponies and the breeding theory, it would be like leaving Hamlet out of the play not to notice the useful work of the Congested Districts Board in this direction, and more particularly the experiments being carried out by Professor Cossar Ewart with the view towards finding out pony stallions for the crofters which shall be more suitable for their mares, while hardiness, cost of keep, utility on the land, adaptableness for hill work or for mounted infantry purposes, and eventual marketing at a profit, are all fully considered, than the present Clydesdale and other cross-bred combinations. These experiments have now been carried on for a few years at The Bungalow, Penicuik, Mid-Lothian. The evolution of a special sire which may be safely used in a given direction requires two or three generations, yet much may be learned from present results. Representatives of all the more noted island and mainland breeds, both colts and mares, have been got together and mated with judgment, the results being noted with scientific accuracy. Ponies of what might be called kindred bloods, like the Connemara, the Iceland, and the Norwegian, are used as well, and several most interesting out-crosses with the Arab have been tried occasionally, also a modern English thoroughbred.

A noted sire at present used is the dark-grey colt by Highland Laddie out of Gaick Calliag, already alluded to in our notes of the Gaick stud. He is a grand upstanding type of the hill pony, which is mostly in demand for deer-stalking purposes, is 14·2 in height, and has plenty of bone, shoulders well set back, and great strength across the loins. A full account of his

Iceland  Norwegian  Rum pony stallion, "Hebridean" "Iona," Rum mare. "Staffa." Rum mare

Fig 6.—*Group of ponies, the property of Lord Arthur Cecil*

ancestry is given in the notes on the Gaick stud (Gaick Calling) and Atholl stud (Herd Laddie).

Quite as interesting as Atholl is the mare which is in foal to him with a view towards getting a good island and mainland cross. This is Benbecula (fig. 7), bred in South Uist, and a very grand type of the fox-coloured, white-maned breed alluded to. Somewhat short in the shoulders, she has great depth of rib, stands square, and has a well-tapered, well-set neck and counter. She is 14·2 hands in height, and measures $7\frac{3}{4}$ under the knee. Set to work in the plough very early, she, like a good many more of the Uist ponies, seems to have a disposition towards easing

Fig 7.—*Benbecula mare.*

(or knuckling) her hind pasterns. She is altogether a very sweet type of a pony mare. Already she has bred a nice 13·0 colt to a pure-bred Norse stallion.

A pure-bred Barra stallion, three-year-old and 12 hands in height, shows all the characteristics of the unmixed pony breeds, and is specially interesting in view of future well-arranged combinations (fig. 8). He is a dark-brown with black points (no white), has the best of feet, and well-turned joints. For hill or contemplated military purposes he has possibly not the necessary weight or size. Something more after what is wanted in these directions will be found in the Barra-Uist combination. This is a grandly set, seven-year-old, 13·3, dark-bay mare, with

neat head, short back, and a saddle look about her. She is in foal to Herd Laddie. A very good specimen of the Barra and garron cross is seen in fig. 9.

From the natural-history point of view possibly the most interesting pony at The Bungalow is the little mare, which may well be described as an Arab in furs, for beneath her tremendous coat of hair she has all the points of the Asiatic breed to which we are chiefly indebted for our modern racehorses. Bred in Iceland, she is blocky in every way, but, like most ponies, possesses good feet and joints. The mane is tremendously thick, and though dark on the outside, is of a yellowish colour

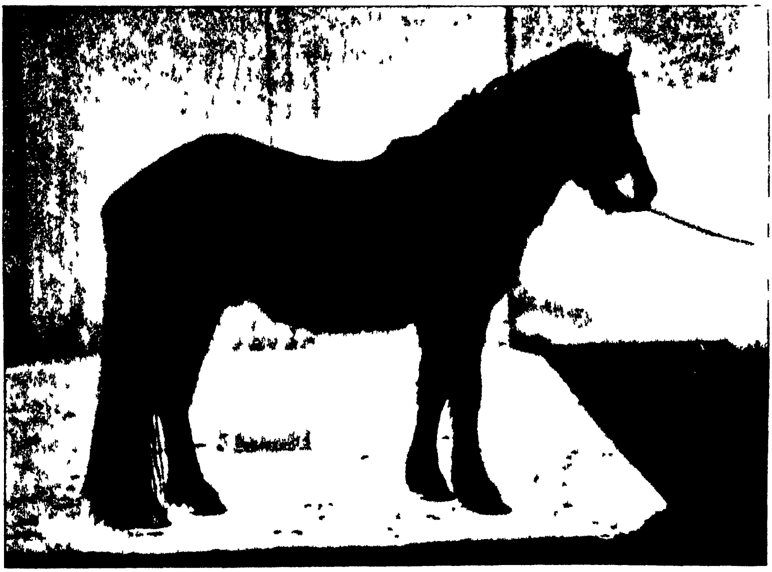


Fig 8.—*Barra stallion.*

within. The most interesting feature about her, no doubt, is the upper portion of the tail, or rather dock. The hair on the upper part of the dock in winter spreads out in something like a fan, and shields the upper and more sensitive parts of the thighs, with the under parts of the body situated forward therefrom, from hard-driven snow (fig. 10). In summer this part of the tail entirely disappears, leaving the under and nerve portion to do its duty in the matter of switching away such flies as may find themselves into northern latitudes.

To those who are studying the question of the production of ponies from a military point of view, the most interesting of the large and varied collection at The Bungalow is the dark-bay mare

with white face by Hadeer, Lord Arthur Cecil's Arab stallion out of a grey Scottish pony of unknown pedigree (fig. 11). She is 14·0 and twelve years old, has beautiful riding shapes, and was declared by Colonel Rimington of Rimington's Scouts fame on a recent visit to be his ideal type for mounted infantry purposes. That this mare is a safe sort to breed from in the infantry remount line is evidenced by her colt from a pure Norse pony stallion, the winner of a first prize at the great Norwegian show at Thorheim. This colt, which will grow to a fair size, has a

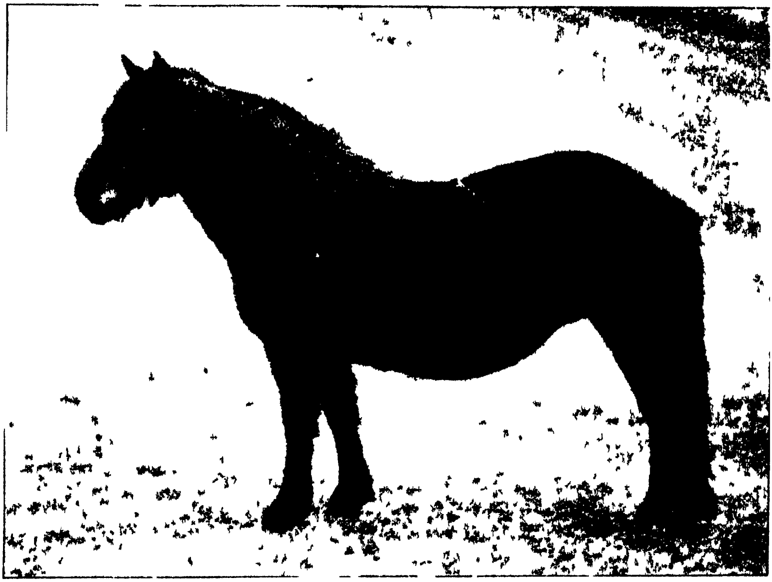


Fig 9.—*Barra and garron cross*

rather captivating, neat, short head, well-set shoulders, and fair length of back. The Scandinavian eel-stripe is carried right down through the tail-head.

An Arab and Skye cross-rising two year-old shows a good deal of the character of the former, though the Skye ponies were no doubt in old times indebted to the Arab for many of their special excellences. A dun eel-backed colt by a Norse sire out of a half-Arab mare (by Hadeer), 13·1, with dark points and absolutely free from white, has true pony character and well-set shoulders. Another colt by Natrone, an Arab stallion belonging to the Congested Districts Board, and out of a Skye mare, is scarcely less interesting (fig. 12). A very sweet Arab and Norse combination is the two-year-old mare, 13·2½, and which combines seemingly the best points of the Asiatic and

northern breeds (fig. 13). Along with the latter is a colt, a combination of the Connemara and thoroughbred, rising 13·2¾, two years, with real good shapes and style. The Connemaras benefit through a climate softened for the greater part of the year by the action of the Gulf Stream, and a good strata of limestone in the dry soil which underlies their pasture.

This particular colt seems exactly the type to put riding fore-ends on to many of our short-necked, short-shouldered Highland ponies. The yellow-coloured dam of this colt, a pure Connemara, has exceedingly blood-like shapes, and quite after the style of remount which is being sought after for most modern cavalry purposes. A misfit as to size for cavalry of the line would naturally enough fall from this into the mounted infantry service.

Fig. 10.—*Celtic pony, showing winter growth of hair on tail.*

A white mare, a present from Sir John Gilmour, Baronet of Montrave, to the Congested Districts Board, is one of the old moss-trooper sort, and takes considerably after Herd Laddie, to which she is related. She is in foal to a Connemara colt, and we think the cross with more blood-like shapes and shoulders might do some good amongst the smaller island ponies in raising them up to the 14·2 standard. There are numerous other ponies —Faroe Island, Iceland, Java, and Shetland—which scarcely come within the purport of this article.[1]

[1] Since the above was in type Atholl, as the property of the Congested District Board, last season served a large number of mares in South Uist. The pure bred Barra stallion, after serving a number of mares, amongst others the Celtic mare which is expected in foal, succumbed to enteritis last winter, much to Professor Cossar Ewart's regret. The colt by Natrone out of a Skye mare has developed into a grand three-year colt, and was purchased by the Congested Districts Board early this year. The Connemara and thoroughbred combination, a yellow dun, has turned out a typical Connemara, thus showing the pre potency of the old Irish breed. She is also the property of the Congested Districts Board, and will serve this season in some part of the north. Sir John Gilmour's mare had a filly foal to the Connemara colt, not quite so good-looking as the dam, but will make a useful brood mare. The mare by Hadeer (Colonel Rimington's ideal) is expected in foal to Mr M'Hardy's Braemore

The connection between the Fell pony and the Highland has been established, as we have seen, by the use of. Sir George blood in the Guisachan and Applecross studs. The relationship no doubt was always very strong, and there is every reason to believe that the Fell pony held full relationship in older times to the Galloway, and that other steed of which Scott in the 'Lay of the Last Minstrel' has written:—

> "At the first plunge the horse sunk low,
> And the water broke over the saddle-bow
> In vain; no torrent deep or broad
> Might bar the bold moss-trooper's road."

Long ere the Curwen Bay made his reputation as one of the foundation sires of the Turf the word Galloway, first used in the time of Edward I., when half the south-west of Scotland was known as Galloway, was applied to all forms of small clever ponies. We are indebted to Lord Arthur Cecil for the following pedigree:—

PEDIGREE OF MR MACKENZIE OF FARR'S HIGHLAND PONY, "JOHNNIE," BRED BY THE LATE SIR ARTHUR FOWLER AT INVERBROOM, GARVE, ROSS-SHIRE, N.B.

| | | | |
|---|---|---|---|
| A very bonny Pony," belonging to Alex Mackenzie of Kildonan, Dundonnell, who sold it to Major Mundell of Invertael, who sold it to the 1st Company of Lovat Scouts. *SIRE.* | A Sutherlandshire Mare, belonging to a Mr C Fraser, who sold it to Mr D Fraser,' gamekeeper, Fannich. This mare had by another horse (a noted one belonging to Mr Roderick Maclennan, Corry, Ullapool) a second foal, which is the famous pony still ridden by Miss Barry of Gruinard. *DAM* | A Yorkshire Cob, the property of the late Charles Hanbury, Esq of Belmont, Herts, and of Strathgarve, Ross-shire. *SIRE* | A handsome Highland Pony, the property of the late Sir John Fowler, Bart. of Braemore *DAM.* |
| "Melvile's Horse," property of William Mackenzie (Melvile), a Dundonnell crofter. This horse has left excellent stock in the country. *SIRE* | | "Mary," a pretty chestnut mare (still living), foaled at Inverbroom about 1876; driven in single and double harness by Sir Arthur Fowler for eighteen years. *DAM.* | |
| | "JOHNNIE," foaled at Inverbroom about 1896 | | |

Though strictly speaking a Lowland stud, that of Mr Graham Hutchison at Barend, Balmaghie, Castle Douglas, Kirkcudbrightshire, requires special mention not only from the fact that it is situated in a country where the Galloway in its original form survived longest, but that the raising of polo-ponies and

infantry remounts is made a special study. It was as the tenant of the farm of Borland, on the Balmaghie estate, that the admitted head of the Clydesdale trade, Mr Andrew Montgomery of Netherhall, first made his distinctive mark. Mr Maurice T. Carr, who manages the Barend stud, makes good use of his 1000 acres, 600 of which are rough hill. Last spring (1904) there were on the farm in all, 3 stallions, 24 mares (3 Clydesdales), and 28 yearlings and two-year-olds. The stallions are De Wet, bay, 14.2, by a thoroughbred, Brosco, imported into Orange River Colony; dam, a Basuto mare; and Arran, a bay Highland

Fig. 11.—Cross from Arab stallion.

stallion; sire, Arabi, a Douglas horse; dam, a Highland mare. De Wet travelled in the Fort-William district in 1902, and Arran followed him on the same circuit in 1903. Recently a chestnut bred in South Africa, sire an Arab, dam a Basuto mare, and showing much Arab blood, has been added to the stud. These are all ridden and driven regularly so are always in a healthy condition. There are several Fell mares in the stud, all hardy, but are considered too small to breed 14.2 ponies, such as are wanted for polo or military work. The stock are in no way pampered, the mares getting nothing but bog-hay. All the ponies likely to make polo-ponies are put to a bending course, and are made used to stick and to ball. Mr

Carr does not anticipate that any difficulty will be experienced in growing ponies up to a 14·2 standard with a little good wintering, and a foal by a Barra pony stallion from a 12·1 Barra mare he expects will grow to 14·0 from the better keep and more favourable climate.[1]

In regard to the different opinions which we have been able to glean on the subject of what is best to bring in from outside, the variety is considerable. Most correspondents agree in keeping out of cart blood, through the modern Clydesdale, far too much of which has crept in of late years. The hackney type,

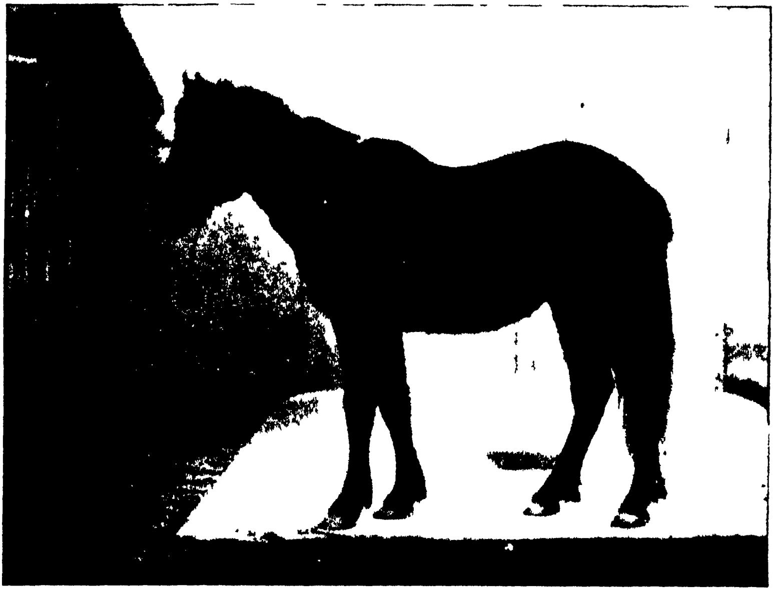


Fig. 12.—*Cross between an Arab stallion and a Skye mare.*

unless modified through the Fell, is not in favour, though many, including Lord Arthur Cecil and Lochiel, would have no objection to the good old-fashioned "saddle roadster," now so very scarce owing to the hackney having been developed of late much

[1] Since the above was in type Mr Hutchison has disposed of a large number of his stud by auction, retaining six mares and foals and three yearlings, also the stallion De Wet, Pax, by De Wet (three-year-old), and Kronstad, by De Wet (three-year-old), the two latter being very promising. Arran was sold at the Highland and Agricultural Society's show at Perth (1901), where he was very highly commended, to Mr Macdonald, Fort-William, N.B. The chestnut Arab-Basuto stallion, which belonged to Mr Carr, was taken south to Addisham, Dover, Kent; Fate, the Barra mare, was purchased by Mr Maxwell, Dalbeattie; the others went mostly to local farmers.

in the line of harness. Mr Christopher W. Wilson's remarks on crossing Fell ponies with hackneys are of course worthy of great consideration. The modern racing thoroughbred does not find so much favour as the Arab, though Lord Tullibardine is of opinion that, if of the right sort, it gets a grand Scottish Horse remount from the garron. It must be recollected, when viewing the matter from this point, that the thoroughbred stallions used in the Scottish Highlands have hitherto been of the most wretched character. The Arab finds solid favour, and more particularly the Arab cross after going back to the High-

Fig. 13 *An Arab Norse cross*

land again. Beyond all this there seems a general desire to build up a reliable breed of Highland ponies through working the island and mainland ponies together—pony style to overcome too much "carty" character, and mainland size to give strength and substance. This will require time, skill, experience in elimination,—the weedy fillies to be sold for tradesmen's purposes,—castration, and registration. Professor Cossar Ewart's results with the different crosses have still to be worked out, though the Connemara promises well for assisting in giving riding shoulders.

In the meantime, from an economic point of view, pony-breeding in the Highlands ought to pay. In the Uists three-

year-olds fetch from £16 to £20, extra good ones £24, and four-year-olds £20 to £28. To bring them to four-year-olds, work for keep considered, does not cost more than £12. One of the Lovat Scouts last year, having a spare pony suitable for a town member, cleared £13 in all—£10 for two horses and his own allowance in wages. Given a good engagement for the hill at the breaking up of the drill in August, when his horse has been put in heart on War Office corn, the crofter ought to make a further harvest, whilst all the time his oats are ripening at home.

## FRUIT CULTURE IN SCOTLAND.

By J. M. Hodge, Blairgowrie.

It was in the year 1871 that the Board of Agriculture first compiled returns showing the acreage under orchard trees in Scotland. The returns for that and the following year were not satisfactory, and in making statistical comparisons it is necessary to start with the year 1873. In 1873 there were 1874 acres of orchard land. Now there are 2490 acres—an increase of 616 acres in thirty-one years.

The first attempt to compile returns showing the acreage under small fruit was made in 1887. In this connection also the returns for the first year were not satisfactory. In fact, in consequence of alterations in the method of collecting these returns, nothing reliable was obtained till 1897. If comparisons are to be made, this year must be taken as the year in which returns were first reliable. In 1897 there were 5214 acres under small fruit in Scotland, and in 1904 there were 6072—an increase of 858 acres in seven years. The total land now under fruit in Scotland extends to 8562 acres.

Fruit culture is carried on to a limited extent in almost every shire from Caithness to Wigton. But the bulk of the fruit is grown in a few counties. The following figures will show the development of the trade in the principal fruit districts during the last seven years:—

| | 1897. | | 1904. | |
|---|---|---|---|---|
| | Small fruit. | Orchard fruit. | Small fruit. | Orchard fruit. |
| | Acres | Acres. | Acres. | Acres |
| Fife | 161 | 54 | 198 | 88 |
| Forfar | 197 | 33 | 274 | 36 |
| Aberdeen | 354 | 10 | 309 | 24 |
| Edinburgh | 268 | 62 | 267 | 77 |
| Haddington | 392 | 143 | 369 | 121 |
| Perth | 852 | 528 | 1646 | 614 |
| Lanark | 1967 | 722 | 1922 | 808 |

### *Fife, Forfar, and Aberdeen.*

The orchard land in Fifeshire is for the most part confined to Newburgh, and the 198 acres of small fruit are scattered pretty well over the county.

There is no particular district in Forfarshire noted for fruit culture; but Kirriemuir, the weaver village of yesterday, is likely to become the Forfarshire fruit-garden of to-morrow. For a number of years Thrums has been thinking of going into fruit. Some months ago, the farm of Knowehead—you remember the farm of Knowehead, made famous in story by Mr J. M. Barrie—was purchased and divided into small holdings. Before long it will be a huge fruit-garden.

The biggest fruit district in Aberdeenshire is on the banks of the Dee, immediately north of the town of Aberdeen. Raspberries and strawberries are also grown at Banchory, and the industry has just been commenced on the low-lying lands of Buchan. The market for most of the fruit is Aberdeen, but some finds its way to the midland towns of England.

### *Lothians.*

According to the agricultural returns, the Lothians grow about 198 acres of tree fruit and 636 acres of small fruit. There is only one district, the district round about the village of Ormiston, where there is a congregation of growers. Fruit-growers in other parts of the Lothians are isolated, which is largely due to the fact that it is very difficult to get much land in any one district. The produce from the gardens of the Lothians is sent for the most part to the Waverley Market, Edinburgh, where many of the growers, capable, intelligent men, have fruit-stalls and attend the market themselves.

### *Lanarkshire.*

These fruit-growing districts are insignificant and almost unimportant when compared with the two great fruit-growing counties of Scotland — Lanarkshire and Perthshire. Lanark fruit covers something like 2730 acres—808 acres being devoted to orchards and 1922 to small fruit. The district, which is not growing, extends along the Clyde valley from Motherwell to Lanark, a distance of about fourteen miles. It is well wooded and picturesque, and the wood makes admirable shelter for the orchard trees. This, however, seems to be almost its only advantage.

The land rises from the river-side very rapidly to the ridge of the hill. The roads to the different railway stations are so

steep that they are wellnigh impassable. Some of the orchards are three or four miles from a railway station. If this land were agricultural land to-day, I cannot think that any fruit-grower would look at it with a view to growing fruit. How it began to grow fruit, I do not know; but fruit has been grown there for hundreds of years: all kinds of fruit—apples, pears, cherries, plums, and bush fruit. Of small fruit, raspberries used to be grown extensively; but fruit-growers found that they did not pay, and stopped growing them. Strawberries seem to be native to the district. I have heard it said—I do not ask you to believe it—that seven tons have been taken off an acre. The usual crop in other districts is about thirty cwts. Two tons, I should say, is a good crop. The Clyde valley, however, is a noted strawberry district, and grows more per acre than any other Scottish district. Good prices are sometimes obtained for dessert fruit, but much of the Clyde strawberry crop goes to preservers. Their average price for the last ten years has been about £20 per ton.

The growing of tomatoes has of late become a rage in the Clyde valley. Tomato houses are being erected everywhere. They cost about £1 per lineal foot when the breadth is 15 feet. I was told that out of a house 100 feet long the proprietor had taken £100. Another grower informed me that this statement was much exaggerated, and put the amount at £50. From this, he explained, there would have to be deducted one-half for expenses. £25, however, is not a bad return from an outlay of £100 in one year. This part of the industry is likely to be developed. There seems to be a demand for Scotch tomatoes: the flavour is better than the flavour of tomatoes grown in the south of England.

Some of the fruit-growers in the Clyde valley do not, however, confine themselves to fruit and tomatoes; and they are wise men in their generation. There are quite a number of ordinary farmers who have gone into the fruit trade, and have found the conjunction profitable. One of the best-known growers has three or four hundred acres of land. He keeps a dairy, and provides himself with manure, and he grows different kinds of fruit. This is the proper kind of holding. There can never be with a man of this kind a total loss in any one year, because his crops will not all fail at the same time.

### *Perthshire.*

The Perthshire district, though not so large as the Lanarkshire district, is in some respects the most notable in Scotland. It contains 614 acres of orchard land and 1646 acres of small fruit. The best-known orchards are in the Carse of Gowrie. You

should see the Carse in the spring time when the trees are in full bloom. Then the most exacting sense of beauty would be satisfied. It is another matter whether the abundant promise is ever fulfilled. There can be no doubt that most of the trees have been neglected; but there are exceptions.

The best orchard is probably the one belonging to Mr Patrick Hunter of Waterybutts. His farm extends to 180 acres, and Mr Hunter is proprietor. Thirty acres are planted with orchard trees. Some of them are remains of an old orchard. Between the older trees younger trees have been planted. A new plantation of 20 acres has been laid down during the last few years. It is yet too early to say whether they will be profitable or not.

Small fruit is not grown in the Carse. It is grown at Blairgowrie, Abernethy, Glenfarg, Crieff, Methven, and in the vicinity of Perth.

The best-known Perthshire district is the Blairgowrie district. Strawberries have been grown in the Muir of Blairgowrie, where the soil is mostly sand and stones, from time immemorial. About twenty-five years ago raspberries were considered a better paying crop, and since then hundreds of acres have been planted out, and the district has extended far beyond Blairgowrie. It may be said to include the fruit lands of Essendy, four miles to the west, where an interesting experiment in the establishment of small holdings is being carried out; the fruit farms at Coupar-Angus, five miles south; and at Alyth, five miles east; and scattered fields from three to six miles north.

This district has shown the most remarkable development of any in Scotland. From the figures which I have given it will be seen that the other districts mentioned have not developed much, and that some of them have actually gone back, whereas Perthshire has been steadily growing, and growing rapidly, during the last year or two. In 1902 there were 1287 acres under small fruit, and in 1904, 1646 acres—an increase of 359 acres. Most of the increase has been in the Blairgowrie district, which has been found exceptionally well suited for the cultivation of raspberries. Two hundred acres will be laid down this year, and very shortly Perthshire will be the premier fruit-growing county in Scotland, and Blairgowrie the largest raspberry district in the United Kingdom.

In this connection the following figures may be interesting. It takes £50, and sometimes more than £50, to bring an acre of raspberries into remunerative bearing. Then the expense of working the acre is considerable. The picking alone costs about £6 per ton. The pickers, I should mention, are paid ½d. per lb., which, however, does not cover all the expenses of picking. It is no uncommon thing for a woman to pick 1 cwt. per day. The

outlay is so heavy that good crops are necessary if the fruit farmer is to get a living wage. There is nothing in the trade, for example, in Kent, where the return per acre varies from 10 to 30 cwt., nor is the profit tempting in other and better districts in England, where the return does not exceed 2 tons per acre. It is different in Blairgowrie. Raspberry-growing pays there, notwithstanding high rents and heavy railway rates, just because of the exceptional crops grown. In ordinary seasons between 3 and 4 tons per acre is not an unusual crop. I have seen 6 tons taken off an acre. The same acre averaged 4 tons for many years. The price varies from £14 to £40 per ton. The average for the last ten years may be put at £26. The return for fruit grown in the immediate vicinity of Blairgowrie every year exceeds £30,000. The Blairgowrie men believe that they will be able to stay in the trade when other growers have to go out, and they are extending their cultivation.

### *Over-Production.*

I have often been asked the question, Whether this development of small fruit culture, especially of raspberries, which are used, as a rule, by the preserver only, will not result in the supply being greater than the demand, and the extermination of many a fruit-grower? I have invariably answered that the increasing acreage under small fruit will in years of plenty glut the market, with the result that the fruit-grower with an acre or two and no capital, in an unsuitable district, will have to go out of the trade, while the larger grower, more favourably situated and with more capital, will live through the lean years and be in a position to reap the benefit of a higher price when better times come.

### *Foreign Competition.*

Foreign competition and the Sugar Convention do not make the growers' prospects any brighter. In fruit trade circles, the dumping in this country of Tasmanian and New Zealand pulp in small tinned jars was looked upon with some apprehension in 1903. Then, the fruit crop in the United Kingdom was a failure. Speculators bought up all the available Australian and New Zealand pulp, with the view of selling it in this country at a ransom, in the beginning of 1904. Instead of fancy prices being obtained, most of it was sold at something over £20 per ton. This meant that the speculators lost much money, and the experiment is not likely to be tried again. Nor would the dumping of colonial pulp be profitable to the colonial grower, were he to get the price ruling in

the British market, because it takes from £17 to £20 per ton to deliver that pulp in Scotland. Dutch fruit-dealers have, however, visited England with the view of studying the methods of colonial growers in pulping and tinning their fruit, and if the Dutch are able to put it up in the same splendid condition that the Colonial does, his competition will be a very serious thing for the grower in this country. We shall await his descent on the British market with some apprehension.

### *Sugar Convention.*

Foreign competition, however, is not by any means such a serious thing as the Sugar Convention and the sugar tax. The price of some kinds of sugar has been doubled, and numerous preserve works have been closed in different parts of the country. If the sugar tax is not removed, and the Sugar Convention not repealed at the earliest possible opportunity, the public will want less fruit because they will not be able to pay the price, and the decreased demand will hasten and intensify the next serious glut in the fruit market.

It is well to look ahead and be prepared for contingencies. To be able to live through the bad years fruit-growers should not confine themselves to any one particular fruit, and they should find out the fruit most suitable for their own district.

A demand is being made just now for the establishment of a pomological department of the Board of Agriculture, which would, among other things, do experimental work. Such a department, however, could not in the nature of things give much assistance in the selection of varieties of fruit, because the soil in different fields, not to speak of different counties, varies so much that what suits one would not suit another. In a matter of that kind every fruit-grower must be his own experimentalist.

I have had some hesitation in saying that fruit-growers should not confine themselves to one kind of fruit, because Blairgowrie, for example, seems to be specially suited for the cultivation of the raspberry, and heavy paying crops are grown, such as are grown nowhere else in the United Kingdom. Still, one would feel safer, even in this district, were all one's eggs not in one basket.

### *Fruit, Cows, Pigs, and Poultry.*

Not only do I suggest as a means of overcoming the gluts of the future that fruit-growers should grow different kinds of fruit and different kinds of vegetables, suitable for their climate and their soil, but I am entirely in favour of the fruit-grower keep-

ing cows, pigs, and poultry, and I have advocated this for many years. Such an association of industries is admirable in every way. I have seen it work splendidly in Denmark. The cows and the pigs make manure for the fruit. This is a most important item when manure costs, as it does in some districts, 10s. or 12s. per ton, and in some cases cannot be had at any figure. Apart, however, from the question of manure, the small holder would not then be dependent upon any one crop. He would have his different varieties of fruit and vegetables and the produce of his little farm. There would be no likelihood of all failing in one year.

### *Home Industries.*

I should also like to see the development of home industries. The small holder could, for example, in winter, when outdoor work was impossible, make fruit barrels and fruit and egg boxes for himself; and I have no doubt that the day is also coming when hours that would otherwise be idle will be profitably occupied with spinning and weaving—the wheel and the loom driven by electricity, which is to be the handmaid of many a rural industry in the years which many of us shall see. It is, of course, quite impossible that such an association of industries could be carried on without co-operation.

### *Co-operation.*

I believe, however, that it will be more difficult in the future than it has been in the past to carry on fruit-growing itself without co-operation; and the co-operative association that sold fruit could equally well run a creamery in every fruit-growing centre, and attend to the sale and distribution of butter, eggs, and poultry, and the products of the long winter time. It is only with co-operation that we shall be able to secure and fully to take advantage of good markets, better railway facilities, and an efficient motor-car service that will open up agricultural districts. Only thus shall we be able to secure a successful development of small holdings at home and face competition from abroad. With our house so set in order I think we may await the future with some confidence.

# LAND: HOW IT IS USED AND ABUSED.

By JAMES LONG, Cudworth Manor, Newdigate, Surrey.

THIS subject has been selected by the writer for the reason that within the past few years he has been able to learn from actual experience, in seeking land in different counties in England, that there is, comparatively speaking, a prodigious area which is practically unused, uncultivated, or entirely derelict. So far as we are aware, the reports of some of the assistant-commissioners to the last Royal Commission on Agriculture, pregnant as they were, did not reach the heart of the subject. That relating to the county of Essex created considerable sensation; but had the same line been taken by other officials, there cannot be a doubt that similar conditions would have been discovered in other counties, if not to the same extent, but with this difference, that while in Essex the land was of the heaviest, deadest description, it was in other counties less plastic, less costly to bring back into cultivation.

It is a common expression among a particular class of farmers that land of this character is not worth cultivating, and that the heavy clays are unworthy of their attention unless they are laid down to grass and nominally rented. It may be pointed out as a fact which is well known to experienced men, that clay (excepting where brick earth, or something closely resembling it, comes right to the surface) produces some of our best pastures, and is especially suitable for the growth of clover, where it is properly dressed with manure for the purpose. Poor grass on clay, therefore, is never to be despised if the land is drained, for it is only a question of time to improve it in such a marked manner that in half a dozen years an absent owner returning to make an inspection would scarcely know it himself. There are large areas of this class of land which are to-day being most thoroughly abused; and side by side with farms and estates consisting of heavy clay soil are other farms and estates of identical character which are splendidly farmed, and which are among the most profitable and handsome to be found in the country.

We may, perhaps, take a sample instance with which we are well acquainted. A small estate in a heavy clay district, purchased by a practical man, a merchant by profession, a dozen years ago, at something like £8 an acre,—as I am given to understand,—was at once taken in hand for improvement. Business men are apt to go to the fountain-head for advice,

and in this case good advice was followed. The land for a number of years in succession was manured, chiefly with basic slag, with the result that it is to-day an oasis in what is otherwise a huge desert; the crops grown are large, the fields are a brilliant green, and the property enormously enhanced in value. One field, wedged in between others on an adjoining property, in 1903 produced a crop of grass extremely thick with clover, which reached almost to the waist; while last year, the season being drier, although not so tall, it was thick, handsome, and luxuriant in the extreme. The adjoining fields, if not altogether barren, carried crops which in two instances practically failed to pay for the labour of harvest; while in the third, where the clay comes nearer to the surface,—the plant consists chiefly of clover and rye-grass,—a respectable yield was obtained owing to the fact that the occupier had supplied manure in two successive seasons. On the latter property there are several occupiers of similar land—indeed some is naturally superior—who cannot be persuaded to employ artificial manure, and who, owing to want of stock, are unable to provide farmyard manure to one-tenth the extent necessary for its proper management.

It has been pointed out that the same rent is payable, almost the same labour involved, the same time and attention demanded by a tenant, whether a crop is manured or whether it is not; while the result of applying suitable manure at a suitable period is in the majority of seasons followed by a handsome net profit in such cases as this, and great satisfaction on the part of the man who reaps it.

On a farm where the soil is lighter in character, the tenant has deliberately—we believe for years—cultivated only one half his land, and that alternately with the other half: we refer to the arable land which is ploughed and cropped, while it is practically not manured, owing to the almost entire absence of stock, his reason being that it does not pay to spend the money upon it. The untouched moiety is sometimes grazed by a flock of sheep owned by a neighbour, and the result is regarded as sufficiently satisfactory in these times of agricultural depression, when the tenant supposes that farmers cannot be expected to spend money either in labour or manure.

Land is abused for various reasons. In some cases it is claimed that there is no capital wherewith to do it justice; in others, there is no stock, which amounts almost to the same thing; but it is probable that in the majority of cases the bad farming which is involved is owing to the inefficiency of the occupier, who, if he looks over his neighbour's hedge and sees good work accomplished, excuses himself on various grounds for not following his example, or who, like traders and professional

men of second-rate calibre, plods along devoid of energy and enterprise, unwilling to learn or to take advantage of the many examples which are afforded him both in public and private practice. We should not forget that the farmer is a man of similar capacity to those of his fellow-men who are engaged in other industries, and we have therefore no more reason to expect him to succeed in all cases, or to at all times adopt a correct course of procedure, than we have to expect the tradesman, the merchant, or the manufacturer to succeed in precisely the same way. In every industry the successful men are the few, the unsuccessful the many, and we are bound to believe that it is not owing in many cases to want of capital, as is so constantly affirmed, but to want of capacity.

It is probable that there are far more farms per cent well managed in Scotland than in England. Again, I believe it to be quite certain that the percentage of farms well managed in England is much higher in the northern counties than in the Midlands, and higher in the Midlands than in the south; and yet in every district in which the writer has travelled there are first-rate tenant-farmers to be found. But what about the multitude of farms unworthy of the name, where the work is slipshod, the land foul, the stock inferior and poor, the buildings in bad repair, the stockyards a disgrace, the annual crops barely sufficient to pay the way, and discontent invariably prevailing. It is fair to point out, perhaps, that there are many farms in this country, especially on our large estates, which are gold mines, as far as gold mines are possible in agriculture. The soil is kind, it has been well farmed for generations, and the occupiers of to-day are fortunate, and know themselves to be fortunate, in being accepted as tenants. On many of these farms the rents are low, much lower indeed than the rents on farms of inferior quality. But these men, and all who appreciate first-class land, fully recognise that an extra 5s. or 10s. an acre in the form of rent is as nothing to the value as between poor and rich land.

It would be just as well if we were all able to divine precisely what is poor and what is good land. Land is often condemned because, having been run down by over-cropping, or under-manuring, or by bad management, it has been allowed to become foul, although it is physically capable of most excellent work. This land is severely avoided by most men in want of farms. Somewhat naturally, men are prone to seek land which is in high condition, but they seldom find it, for such land is rarely in the market. But at the same time it is curiously unwise to condemn land which is of a naturally useful character because of the previous tenant's neglect. There is an unwillingness on the part of owners to reduce the rents of such land in order to obtain tenants, and curiously an equal

unwillingness on the part of tenants to rent such land, even though the rents fixed are low and practical, permitting them, in a word, to put what grit they possess into it, and to make it pay its way. Many a man makes a mistake in declining a farm because it has been run down. Its natural character is such that it will bear good crops under good management, but there is a rooted objection to the labour of bringing it back into condition. A summer's fallow in a hot season, or, it may be, on some parts of the farm a two-years' fallow of the arable land, would not only prove effective in restoring cleanliness, but in partly restoring fertility.

Where the land is cleaned the restoration of fertility is not difficult. If manure made on the farm, or obtainable from some great city, is not possible, it is still possible to employ artificials either for direct application to marketable crops or for the purpose of green crops intended to be ploughed-in as green manure,—we speak for the moment of the heavier soils upon which rape, mustard, vetches, and *Trifolium incarnatum* may be sown for this very purpose by the aid of phosphatic manures. The ploughing-in of a crop of vetches not only imparts plenty of fertility, the phosphates which were originally employed in their growth being supplemented by the nitrogen which the vetches have gathered from the atmosphere, but the green crop itself has the same influence as dung in its improvement of the mechanical texture of the soil and in its addition to the soil of organic matter, and, consequently, of its moisture-retaining power, and, after all, this power is one of the chief features in a fertile soil.

No methods of cultivation, no expense and liberality in the use of artificial manures, will avail, if a soil will not retain sufficient moisture to enable the properties of the manure which plants require to find its way into their systems. There cannot be a shadow of doubt that in seasons of drought many farmers suffer severely from this very cause, absence of retentive power in the soil they occupy. They are perhaps careful managers, employing liberal quantities of artificials, but failing to recognise the one great fact that their particular soil suffers during dry weather, and that, in consequence, it is essential to fortify it from time to time with dung or its equivalent in some form or other.

Again, it is important to remember that a heavy soil should be cultivated to a greater depth than is common, and that the subsoiler should be used as often as possible, that the pan beneath, which the plough has seldom penetrated, may be broken up, making way for the roots of those plants which, where possible, will penetrate deeper into the earth in search of moisture. An instance has recently come under the notice

of the writer which emphasises this particular point. On a farm with which we are acquainted three fields were wholly or in part treated in different ways, all being more or less of a heavy character. In one case the plough penetrated no more than 6 inches. Although dung and artificials were both employed, the crop was a poor one, and possibly did not pay for the cost involved. In another case the subsoil plough was used, the land being practically plastic. Here, again, the work was not entirely successful, partly owing to the season which followed and to the time when the work was performed. In the third case a portion of a field was intended to be employed for growing market-garden crops. The spade was, in consequence, used, and the land was trenched to a depth of about 18 inches, the subsoil being naturally kept in its place. The work was thoroughly done, with the result that without manure the crops grown were among the best on the farm.

This instance is quoted not with the object of suggesting to agriculturists that their corn-fields should be double-digged with the spade, but that the principle may be recognised and followed as far as practicable; and for this reason it would appear that while subsoiling with horse-labour is quite a second-rate process as compared with work performed with the spade, the time has arrived when by the aid of steam-diggers or motors something may be attempted, and even accomplished, which will do as much and even more than can be accomplished by hand and spade labour, and of course at infinitely smaller cost. The digging plough, working on the disc principle, which was exhibited at the Royal Agricultural Show some three or four years ago, has commended itself to the notice of the writer as to many other persons, for the simple reason that it is calculated not only to move the soil to the depth required, but to move it most effectually and rapidly. If by labour of this character larger crops can be obtained,—and it is certain they would be, if there is anything in the principles of soil-culture which science has taught,—then it follows that the work ought to be attempted, for manure would go further, while by repeated moving in the manner indicated the soil would yield up its, at this moment, hidden fertile treasures for the use of plant-life, the elements being better enabled to do their work effectually in preparing for that use the substances in the subsoil which are now unavailable.

There are some readers who will remember to have read accounts of the cultivation of poor soils in Belgium—soils which in many cases were formerly regarded as useless, but which, by the adoption of scientific principles carried into practice, have been made fertile and profitable. In one instance an extremely infertile soil was liberally manured with phosphatic and potassic

fertilisers, and lupins were sown. The lupin is a deep-rooted plant, penetrating to considerable depth below. Knowledge of this fact was utilised in the production of succeeding crops. It was found that where the roots of the lupin had penetrated into the subsoil the roots of other less determined plants were able to follow, and follow they did in search of moisture, the supply of which was half the battle. It has been noticed from time to time that lucerne, one of the deepest-rooted of farm plants, has penetrated from 20 to 30 feet beneath the surface. Many years ago Sir John Lawes showed the writer on one of his experimental plots that lucerne roots had been traced to a depth of nearly 19 feet—we speak from memory—by himself and his assistants, who were at that time in search of the source from which nitrogenous plants obtained their nitrogen.

It is clear that if man would utilise the soil of the earth he must take it as he finds it, and do his best to adapt it to the production of crops. If, like sand and gravel, it is dry when it should be moist and retentive, he must impart to it that character which will enable it to retain moisture as far as he can. If it is a thin chalk, with barely sufficient surface to carry plant life, he must seek to deepen the surface and at the same time to grow such shallow-rooted plants as are adapted to the circumstances; and to a large extent this has been done both by individuals and peoples. But there is much to do, and although we need not despair of this much being accomplished in the future, there are few indications in the present day of the willingness of either individuals to undertake such difficult tasks, or of Government to experiment, or still better to help those men who are willing to undertake the work of tillage of poor land under such conditions as would benefit themselves and the community at large.

There is such a hunger for soil in all countries that it has been regarded by some as almost criminal to refuse capable men a few acres while millions of acres are lying practically idle. The refusal is not a question of exact practice, but of the absence of any medium. The landowner cannot be expected to hand over a dozen acres to every or any applicant whom he may come across; while in the absence of a medium, a man thirsting for land in order to work upon it is unable to acquire it unless he has capital, in which case he very naturally seeks for land in already good condition. Governments, in their turn, having failed to legislate, have no means of acquiring land for the purpose we have indicated, and, therefore, of handing it over to selected men; yet we believe it to be certain that if some such system existed here as exists in Denmark,—under which small areas of land are sold to labourers of known and proved character, and who are selected and recommended by a committee

especially formed for the purpose, upon payment of nominal sums during a term of years,—there would not only be many applicants, but applicants who, in the majority of cases, would put their muscle into the work, reclaim the land, and benefit the community at the same time as themselves, for the simple reason that, being their own, they would be stirred by an ambition which cannot be imparted in any other way.

Some years ago an extremely important experiment was completed by a French scientist, since dead, who had been endeavouring to ascertain as conclusively as possible what actually constituted a model or perfect soil. Crops were grown with great diligence under various conditions, and the result was the conclusion that the best soil for agricultural crops, and they were produced during the experiments, was one consisting of equal parts of sandy, chalky, clayey, and peaty matter, not by weight, but by volume. It will be observed that the sand supplied the material which made the soil porous and mechanically adapted to its purpose; the peat provided the organic matter and the resulting humus, in addition to which it assists immensely in the retention of moisture at a time when moisture is most needed, and in the warming of the soil as it gradually undergoes decomposition; the clay furnishes the retentive and substantial matter which gives a soil compactness and consistence, and which helps to consolidate and to provide a firm seed-bed, apart from which it also furnishes essential constituents of plant life. Again, the chalk soil—we do not speak of chalk, and this fact is all-important in each case, for we refer, for example, not to sand, but to sandy soil and the like—would provide the lime which has so many functions, more, perhaps than any other constituent of soil, and which would adapt it to the growth of crops other than those which are commonly found upon the average farm.

This is an important instance, as showing what is possible in the formation of a garden, or in the improvement of agricultural soil. But few men are so situated that they can obtain the materials, or those of an approximate character, which are here referred to. The clay-land farmer, while able to obtain dung, which provides what is supplied by peat,—organic matter,—is seldom able to obtain sand or chalk, under specially economic conditions, to make it worth while to use them in sufficient abundance; but where sand is obtainable in large quantities, or where chalk is within a convenient distance, both are found of enormous value in improving the texture of the clay, and, in conjunction with dung, of enabling it to grow luxuriant crops. Many clays have, indeed, in the past—although the process is a long and tedious one—been converted into loams, so far as the top spit is concerned, by the liberal employment

of dung, with and without such a material as sand. And similarly, sour clays by liming or chalking have been induced to grow crops also by the aid of dung, which were impossible before the amelioration was commenced.

What is possible on the most unkind type of soil may be seen upon the farm of Mr Meeson, in one of the heaviest clay districts of South Essex. This gentleman, who drove the writer some few years ago a very long trip through the very district on which he is an authority, at a time when almost every farm was derelict, informed us that fifty years before he sold wheat in London at a price which we almost fear to quote from memory, it was so high. The grain was put on barges, on the adjoining river, and taken round by the Thames. The crop was not only well sold, but it was a large one, and grown upon the same clay to which we have referred as being in so many cases abandoned, although to-day almost every farm has been sold and occupied. Since that period I have had the advantage of driving through Mr Meeson's farm with one of the principal agents in that part of the county, and, although it must be admitted that it had been in the same hands for a long period of time, and was, therefore, well under control, it is not difficult to realise how possible it is by persistent effort, skill, and complete knowledge of the subject, to bring the most unkind clay at the feet, as it were, of the occupier, and to make it grow practically what he chooses, so far as it is adapted to particular crops.

At a still later date, indeed some two years ago, I was invited by a large Cheshire landowner, Mr James Tomkinson, M.P., to go down with him into Warwickshire and examine a clay farm, of a type somewhat common in that part of the county, where much land was in almost as abandoned a condition as that to which I have referred in Essex. The farm in question had been purchased some four or five years before while in extremely bad condition—foul, poor, and next door to derelict. Mr Tomkinson's plan was to place it in charge of one of those capable, determined, practical Cheshire men, who had been drilled from boyhood in the cultivation of the soil and the management of stock. The selected tenant, who necessarily enjoyed the confidence of his landlord, had got the farm almost entirely round, although there were sufficient traces of its previous condition to enable me to realise what it had been like, while land in the neighbourhood of similar character was an additional testimony to the improvement which had been made. Here were luxuriant crops, improved pastures, well-kept buildings, plenty of stock in good condition, and all humming with prosperity, the tenant and his wife models of thrift, industry, and *bonhomie*. I have seldom received a lesson more instructive and at the same

time more captivating. The teaching was twofold, for it shows, in the first place, what can be done for heavy land in working order by perseverance and diligence, and, in the next place, how much depends upon the personal character, capacity, and industry of a farmer. In the hands of such men the derelict, the uncultivated, and the half-farmed land of England would not remain as it is for one single year. And what applies to England applies equally to Scotland and to Scotsmen, for no tenant-farmers, collectively or individually, could have accomplished more in the regeneration of a large proportion of Essex and other counties where labour and skill were essential than has been accomplished by men from across the border.

Let us now turn to soil of a different character,—that with a subsoil of chalk and with a thin layer on the surface, upon which barley, oats, turnips, and sometimes sainfoin and crimson clover, can be grown with some success, although that success depends entirely upon the thoroughness with which the work has been accomplished. The chalky lands of the Downs have, since the early days of the writer, in some districts at least, been much more generally placed under the plough. The grass produced on this soil for sheep—and it was merely a sheep-run in earlier days—is small in quantity, and there can be little doubt poor in quality. Manuring was practically unknown except so far as it was manured by the sheep running over it The plough, however, has increased the depth of the soil, and by the aid of manure and constant cultivation under arable conditions greater crop-growing capacity has been produced.

I take an impoverished farm which came into the hands of a well-known sheep-breeder, who not only realises high prices for pedigree stock, but who practically farms as a crop-grower through the medium of his sheep. In other words, the land is all fallowed, or nearly so, the sheep consuming the green crops and roots growing from year to year, and at the same time obtaining liberal rations of hay, cake, and corn. Land with a subsoil of chalk tolerably near the surface is suitable for sheep, and is dry and healthy, quite unlike the heavy sour soils, which remain wet for a large part of the year, and which grow herbage and weeds of an obnoxious character. The roots and catch-crops are grown especially for the sheep. They help in the production of the animal, and necessarily the very best work must be accomplished in order that the stock may be well grown; while in their turn the sheep, as already suggested, folded from week to week, consume the crops, return to the soil a very large proportion of the fertilising matter which those crops contain, and by means of which they have been produced, and still more, a considerable percentage of the nitrogen, phosphoric acid, and potash present in the cake and corn which is supplied them

from outside. No wonder, then, that this land is enriched, that fairly good crops of barley and oats are grown, and that the artificial grasses are more or less luxuriant.

To the farm to which reference is being made a large area had just been added at the time of my visit of inspection. The addition was soil in very poor as well as foul condition; and in explanation of his becoming tenant of this land, my host pointed out to me that the rent was low,—a few shillings per acre only,—that three or four years would suffice to clean it and to bring it into respectable crop-growing condition, while it would be found possible to get through the extra work with comparatively little, if any, tangible addition to the staff of the farm. Large and good farmers have in many cases been able to increase the area under their occupation in this way when land adjoining them has come into the market to let. Agents, satisfied as to their ability and trustworthiness, frequently make them the first offer, and the rent oftentimes being nominal, they decide to accept, first because the rent is insignificant, and next because they are so well staffed that an additional hundred acres or more makes but little difference to their regular expenses.

I am acquainted with a similar instance in Norfolk, where a farm, which would prove a fortune to a diligent beginner, was offered to a large and capable tenant at an exceptionally nominal figure, and accepted for the reasons which have just been advanced. Here, however, the soil was of most excellent character, while the occupation was so desirable that it would never have gone begging were it inspected by a few men on the look-out for a good farm.

Such facts as these are sufficient to justify the belief that thousands of acres of the chalky land of the country, which are mere sheep-runs, might be cultivated as arable land with immense advantage to both owners and occupiers. As sheep-runs they may remain as they are for centuries without exhibiting any tangible improvement in their character, whereas under arable cultivation every decade should show an improvement where that cultivation is thorough. As it is, however, we cannot but regard this class of land as being abused instead of being used.

Men seeking land which they desire may become their own, as well as men seeking to rent land, are leaving the country every year because they are unable to find it. I have had letters from correspondents from time to time to this effect. Still more have I had letters from over 1500 applicants within the past two years who profess to be wanting land—although generally in small lots—which they can cultivate and enjoy in their own particular way. While this is the case, the country,

if marked in colours on a specially arranged map, would be found to be in possession of a prodigious area which is either uncultivated, more or less derelict, or abandoned, or which, if in occupation, is a mere run for sheep and cattle.

Bare fallow land growing no crops whatever reached in the past year no less than 351,000 acres, or 81,500 acres more than in the preceding year, while the mountain and heath land, which is more or less grazed by stock of some kind, reached 12,800,000 acres. Admitting that a huge proportion of this must for all time be unfit for any form of cultivation,—chalk, stone, or gravel being on the actual surface,—yet there is a very large area indeed which, under various forms of cultivation, might and ought to be utilised for the benefit of the whole country; that it might be improved and made to pay its way, were it by some national effort placed in the hands of men whose labour is their capital, we are entirely convinced.

We come next to the gravels and sands, two classes of soil which under ordinary circumstances of cultivation are heart-breaking to men who are lacking in grit, determination, and patience; and yet the Germans have accomplished great results upon soil of a sandy character. Just as clay is reduced by the aid of sand, and made mechanically easier to till, while the rain percolates through it with greater facility, so that a greater variety of crops can be grown upon it, so does a sandy soil need increased substance that water may be retained, that plant food may be provided, and that improved texture may result.

It has been shown by experimental work of a remarkable character at the agricultural station at Madison, that a crop of 75 bushels of oats used up 1538 tons of water, while a crop of barley of 40 bushels used up 816 tons. Each pound of dry matter produced on the average of two years required in its production 392 lb. of water, while the average production of dry matter per acre was nearly 5½ tons as against 2·08 tons in the field under normal conditions, the first figures relating to the tests which were made in cylinders and arranged so as to resemble the field as nearly as possible. During the growth of the crop the water added to the soil in the cylinders was at the rate of 1321 tons per acre more than fell in the form of rain upon the field itself; that is to say, the water supplied to the barley, which was tested in this way, was 2·74 times as large as that which was supplied by the rain, whereas the yield per acre produced by the addition of this larger proportion of water was 2 6 times as large as that in the field crop. The field crop indeed was 40 bushels an acre, while the cylinder crop reached 104 bushels an acre, and yet the cylinders restricted the roots of the plants to the available area supplied. Again, there were three trials with oats, and it was found that

the water which this plant required was 505 lb. per lb. of dry matter, the average production of dry matter per acre being 4¼ tons against 3·04 tons produced in the field actually adjoining. The water added to the soil in the cylinder was 406 tons per acre more than was added in the field by the rain, or 2½ times as much, while the yield obtained was 1·4 times as large. The field crop reached 70 bushels to the acre, while the cylinder crop reached 98 bushels. Red clover was grown in the same way during two years, and on the basis of three trials, and here each pound of dry matter required 452 lb. of water, while the average amount of water per acre was 2193 tons, equal to the production of 4·8 tons of dry matter, or 5·7 tons of hay, containing the average percentage of moisture upon the basis of the analysis generally accepted. Here we have results showing that by the liberal supply of water three varieties of crop, to which we may add maize, making four in all, when supplied with water at the rate of 1·8 to 2·8 times as much as the rainfall, made a return on the average of the whole of 2·34 times the yield in the field.

Now perhaps we are better able to understand the importance of the improvement of substance and compactness, especially when compactness is the result of adding organic matter in a light sandy or gravelly soil. Just as the market-gardener or the florist by providing a mulch prevents the evaporation of moisture from the soil around the roots of his plants, by which they are enabled to grow much more freely, so is it essential that the grower of farm crops should provide as much material, let us call it mulch if we like, as will prevent similar evaporation, or still further, as will tend to retain the moisture in the soil to as great an extent as possible short of making it wet or boggy, a thing which is practically impossible in a sandy or a gravelly soil where there is no retentive or impervious clay very near the surface. It is the organic matter which, acting almost like a sponge, retains moisture when it is needed, and permits of its percolation into the subsoil when it is in excess.

A sandy loam is a kind soil, in which various crops can be grown with great success—especially the potato, which assumes better form owing to the smaller and even resistance to which it is subjected in its expansion; but even a sandy loam requires the constant application of dung as well as of artificial manure. Artificial manure alone is of little value in the heavier as in the lighter soils. The soluble nitrate of soda quickly passes through and into the drainage water, while in all dry seasons the mineral fertilisers are not utilised to anything like their full extent for want of moisture. Therefore, unless sufficient moisture is provided, plants cannot feed, and consequently cannot grow. Their food, as we have seen, passes into their systems through the

medium of water, and where water is constantly being taken up by the root and leaving the plant by transpiration, it follows, as the above figures show, that a very large quantity is utilised in this way in the year.

So far as we know there is only one method which at this moment is practical for the improvement of the light sands and gravels. We are aware that the distribution of dung materially assists, and that its value cannot be minimised, but a dressing yearly, although this is impossible on light-land farms, would not go sufficiently far to enable the grower to produce heavy crops, and it is very largely for this reason that these very light soils are so little valued and so often abandoned to nature. It is possible, however, to do something by persistent effort, based on the teaching of scientific work, and what has been done, we may rest assured, can be done again.

Both in Denmark and Germany sands have been improved and brought under regular cultivation under the system of green manuring. We may suppose that a field, tolerably clean, is well supplied with dressings of potash and phosphates—phosphates of an alkaline character,—the vetches are sown and well rolled in, for although the vetch loves a somewhat rough surface, compactness improves a light soil. The winter season provides the moisture, and by the spring—the roots having had time to find their way beneath and to protect themselves against frosts, as well as to supply themselves with water—the crop reaches a height or weight in proportion as the soil is suitable or has been fed. It is then ploughed under, and whether it reaches ten, fifteen, or twenty tons an acre, it is quite clear that it provides a basis for the future crop, inasmuch as it supplies the soil with the two properties it most urgently needs, fertility and organic matter.

How many estates are there in this country portions of which are suitable to this form of cultivation, but upon which it has never been attempted! The ploughing-in of mustard and rape, as of crimson clover, trefoil, and vetches,—the last three being essentially rich in nitrogen,—is a proposition which many among us must consider more thoroughly than we have been accustomed to do. There is, however, this great difference in ploughing-in a leguminous crop like the three last named, that we not only return to the soil the potash and phosphates which they have drawn from it, but at the same time we return the nitrogen which they have been enabled to absorb from the atmosphere; and it is in part for this reason that green manuring is so extremely valuable. The most costly element in artificial manuring, as in farmyard dung, is nitrogen; but that is precisely the one element which we obtain gratis when we employ either of the leguminosæ, and especially when we feed

them, for the purpose of doing their work better, with the two mineral manures.

It may be at once admitted that there is no farming better than that which is conducted by the best Scotsmen and Englishmen; but it is doubtful whether in either country science is applied to practice to the same extent as is the case in some of the countries on the Continent. It is possible to travel abroad and to see very little that is worthy of attention. Both by road and rail the *voyageur* passes through hundreds of miles of country—unless the picked districts are selected—the crops of which are inferior and the land not tilled as it might be. Nevertheless, if inquiries are made as to where good farming can be found, it is possible to go direct to farm after farm and to see work which cannot be excelled in this country. The writer, for example, has found in the north of Denmark (Jutland) soil of naturally second-class character made to grow large crops for the feeding of dairy cattle for the production of butter. In Holland, it is true, a very large proportion of the grass-land which feeds the famous Dutch cows is of high quality; but here, be it remembered, the small farmers, the majority of whom own the land, pay almost as much attention to the employment and salvage of manure, and even in many cases to the employment of artificials, as others pay to the cows themselves. I cannot recollect an instance in which the manure-heap was found out of doors in the province of North Holland, and consequently where it was subjected to washing and spoliation by rain; indeed, less attention is paid to their own health by the farming classes, for it is obvious that manure kept in close proximity to their living-rooms cannot conduce either to perfect hygiene or sanitation.

There are farms within reach of Paris by horse and cart which, if we may take example from one instance shown to a party attending the Congress of 1900, could scarcely be excelled in this or any other country; and it is one more example of how land is used. The chief productions, or we may as well say products, were milk and sugar. A considerable herd of cattle was kept for the sale of bottled milk in the Paris market, this milk realising an exceptionally high price, and being delivered daily to the consumer. Sugar-beet was grown, and the pulp, after the extraction of the sugar, supplied to the cattle. The heavier products taken to Paris, grain in particular, provided the means of obtaining farmyard manure, and the farmer laid himself out to such an extent that he was continually sending out produce and bringing back dung; indeed in this way many English farmers have been enabled to keep their land under a system of continuous improvement by sending into London, Manchester, Liverpool, or Glasgow hay

and straw, vegetables, and other produce which bulk large, which require vehicles of great size, and which in consequence enable them to obtain plenty of good straw-made manure.

Why is it, may we ask, that so much trouble is taken by some men in our country to improve the land in occupation, while absolutely no trouble is taken by others whose land requires improvement the most? It might be assumed that the farmer occupying land in high condition would be precisely the man who would not require to employ manure to so large an extent, and that the man with the unimproved farm would, above all, be the man who would seek to improve it the most. But this is not the case. Farmers are like toilers in other industries. Of a given number a small minority do first-class work, a minority do exceptionally poor work, while the large majority are more or less careless and indifferent, or unwilling to spend a shilling in the purchase of fertilising matter for the improvement of the land owned by other people.

Making a start from a south of England market-town of a somewhat old-world character, and driving in any direction within a radius of eight miles, we shall find some thousands of acres which are practically abandoned by both owners and tenants. The local councils, especially concerned about the construction of cottages, the sampling of water from new wells, and the perfection of drainage arrangements to new houses, are just as oblivious and careless about the maintenance of the hedges and roads as they are about the water which the people inhabiting old cottages drink, or the cases of disease which occur owing to the outpouring of sewage into the ditches on the sides of the roads. The hedges themselves may be anything from six to twelve yards through, and for this reason the ordinary traveller sees nothing of what is on the other side, although he may regard the occupier with some suspicion on account of their neglect. The land to which we refer is supposed to be farmed, but nothing is done to improve it. In some cases it is grazed, chiefly, we should assume, by the stock owned by other people, but as a general rule there is nothing either to graze or to mow. The land is chiefly arable which has been allowed to take its course, and to "tumble down," as it were, to grass. In the winter many of the fields are more or less black with dead and frosted thistles, and on examination we believe it would be found that in practically every case the weeds are more numerous than the grasses. This land is heavy, costly to till, and therefore to bring back to good cultivation, with the result that when half attempts are made, as they are from time to time, more money is lost, and the thing is abandoned. The occupiers are in many cases, if we may judge by their work, persons want-

ing in knowledge as much as they are wanting in money; and to those who, like the writer, have tramped over a number of these estates, it cannot but be heart-breaking to think that while agriculture is to some extent under a cloud, while men are asking for land and leaving the country because they cannot obtain it, there should be so much which is not feeding a rabbit, which is not taking its fair share in the feeding of the people, in the paying of the rates and taxes, and of the maintenance of the working classes. Indeed, on this latter point it may be mentioned that the country is essentially bare, with very few inhabitants to the acre, although the district is practically within an hour of London.

It will have been gleaned from what has already been said that the writer holds the opinion that the State should interfere, if necessary, to require owners and occupiers of land, which is at the moment in a useless condition, either to set about its immediate cultivation or, on given conditions, to hand it over to the public, that it may be utilised and become what all land should be, a national asset.

It is not surprising that men like Mr Will Crooks, M.P., should sketch out schemes with the object of employing the unemployed on the land when they become aware of the fact that there are so many broad acres waiting for hands to till them. Mr Crooks has suggested that in every English county there should be three large farms, to which should be sent the unemployed, who should be compelled to work and to settle down in the country, and young men, who should be taught the theory and practice of farming in order to fit them for a career on the land. In this way at least large numbers of loafers and others unemployed, who want nothing so little as employment, might be compelled to earn their own livelihood, and to relieve the rates by means of which they are now so largely kept.

In addition, however, there would unquestionably be large numbers of persons who would delight in a country life, but who, from causes which are known to all connected with the land, are practically unable to obtain employment. There is plenty of abused land in every English county to provide for people of these classes, and it would be wiser of either imperial or local authorities to spend money in its acquisition and management than to continue on present lines, and to provide such huge sums for the relief of the poor and the vagrant; and yet this is only one-half of the story. The lunatic asylum and the prison are the unwelcome resort of men and women who might have been reclaimed under some such scheme had they been taken in hand before the commencement of their careers of crime.

The writer has some experience of the market price of land in many parts of this country. Within the last three years he has inspected estates in a number of counties, and although it is true that in large numbers of instances estates of from 350 to 700 acres are valued as high as from £50 an acre and even more, there are others which by good management might be made to produce equally profitable crops which could be purchased at from one-third to one-fourth the money. It is true that the cheaper land is more or less confined to a minimum number of counties. It is sometimes on the chalk, but more often on the clay; and no prophet is needed to point out that clay soil, even though it be of a heavy character, which has grown magnificent crops of beans and mangels in the past, will in the hands of competent men do precisely as good work in the future. With its improvement or reclamation it becomes both lettable and saleable, for it is precisely the cost of reclamation that prevents the farmer renting it and the small capitalist buying it.

Although the majority of men hunger for land, either to labour upon it or to manage it, it is only the little man who is willing to rent or to buy land which is in poor condition. But even this he is unable to obtain, for the reason that owners, even of the cheaper class of properties to which we have referred, are unwilling to cut them up, and still more unwilling to build for the purpose of the small holder. Some of the most beautiful lands in the country, with which the writer is acquainted, were purchased not many years ago at from £10 to £15 per acre. They have become what they are by judicious expenditure of capital, and within a reasonable distance of any important town there is a marked appreciation in value owing in part to the increased hunger of buyers and renters, in part to the increase in the population, and in part to the advent of the motor-car.

We believe that as a rule the buyer or the agent of the buyer of land values it on inspection rather from the point of view of its present condition than of its latent worth. There is a potential value in land, which so many ignore, and instead of estimating it on the basis of its appearance—its overgrown hedges, its broken gates, its foul and poor arable fields which may not have received the attention of the plough for a decade, its blocked drains and ditches, and dilapidated cottages, gardens, and orchards—it would be well if the soil itself were examined, both by practical and scientific men, with the especial object of ascertaining what possibilities exist for the production of crops in the future.

With sufficient means available it is not really difficult to transform land. A field to-day which many would refuse at

£10 an acre, on account of its destitute and derelict condition, may become the park of to-morrow, adorned with its mansion, its highly cultured and well-stocked pleasure-grounds and gardens, its well-kept hedges and handsome gates, and, we may add, its luxuriant pastures. We have such a property in view as we write these remarks, and one in which in summer the Jersey cows of the owner are wading up to their knees in rich grass and clover, while on similar adjoining land, which has not received the same attention, there is as much difference as between prosperity and adversity.

Let us put the question in another way. An estate is purchased at a low price per acre; it is cut up into small properties; instead of one occupier, with two or three employees, a low rent, and still lower rates, the land is divided into from twenty-five to thirty occupations. In due course, each occupier having purchased his holding, manages to build his homestead, small and modest though it be. At once the local authorities raise the rates, and instead of, as in the union to which the parish belongs, the rates being diminished by 15 per cent or 20 per cent as compared with the previous decade, they at once rise to from 20 per cent to 30 per cent above those of neighbouring parishes. In a word, the property, in place of supporting a tenant farmer, who failed to pay his way, and a couple of labouring families, manages to maintain twenty-five to thirty families, who employ large sums of money in building, and to reduce the rates materially for the benefit of the ratepayers in general. We can apply these facts to at least two estates, of which we have actual knowledge on the subject.

The fact remains, and it has been proved over and over again, that by purchasing a large area of land the price per acre is invariably low, while when the same land is cut up into a number of properties it rises considerably in value and consequently in price, owing to the fact that the persons capable of buying a small acreage are infinitely more numerous than those who are capable of buying a large acreage. It is once more a question of supply and demand. There is little demand for farms of 500 acres; there is a great demand for holdings of from 3 to 10 acres, and the demand is increased in proportion as the system under which the small man is able to buy is simplified.

# METHODS OF TILLAGE: OLD AND NEW.

By PRIMROSE M'CONNEL, B.Sc., F.H.A.S., F.G.S., Ongarpark Hall, Essex.

IN an article on tillage implements which appeared in the 'Transactions'[1] about ten years ago, the present writer gave a short sketch of the history of these implements and their use. In the present instance it is proposed to give a short *résumé* of the subject and bring it down to date, as it were.

These last ten or twelve years have seen great changes in our ideas on ploughing and cultivating land, and in our methods of doing the work. This is more particularly the case in our Colonies and the United States, and as these are our most important competitors, some description of the methods they use in working their arable land will also be given.

In ancient times,—for thousands of years and till long after the Roman domination,—the only form of implement used for cultivating land was a sort of hoe or pick known as the *Sarcle*, with which the soil was broken up by hand. The plough used with oxen was only a modification of the *Sarcle*, made out of the crooked branch of a tree, and it was not until Saxon times that the plough as we know it began to be evolved—the iron plough being an innovation not much over a hundred years old.

The first great change took place some twenty-five to thirty years ago, when the American chilled-steel plough was introduced, which has revolutionised all our ideas on ploughs and ploughing. Up till that date the operation had consisted in cutting off a wad of soil from one side of the furrow, turning it over through an angle of 135°, and leaving it deposited at the other side of the furrow, partly upside down and in a wholly unbroken state. In stiff land the furrow-slices were squeezed and packed together, like so many bars of soap, and the soil left in a most unsuitable condition for seeding. In districts where there was a sufficiency of winter frost, and only spring corn was sown, the soil was mellowed and made friable enough before spring, but where the land was required for crop immediately, or where there was little winter frost, it remained in a solid tough condition. With such ploughing it was often said that a rat could run from one end of a field to another in the hollow left between the slices. This state of matters was particularly bad in its effects in a dry year, for these hollow furrows prevented the plant from getting a proper root-hold, and the crop often failed

[1] Vol. VI., Fifth Series, 1894.

where a better system of ploughing would have saved it. That better system is now coming more and more into vogue, while the implements first designed for the work are getting improved steadily as the years go on.

It is interesting and instructive to take a look at what some of the old methods of cultivation were, and indeed are; for it will no doubt surprise many to find that, notwithstanding the many inventions which have been adopted in modern times in connection with the cultivation of land, there are some of the old primitive methods still in use in various corners of the country—methods which were antecedent to the use even of the plough. The accompanying sketch (fig. 14)[1] represents a scene reported to be of regular occurrence on some parts of the Cotswold Hills up to a few years ago, if not still followed. The implement resembled in appearance and use the old "flauchter-spade" of Scotland, which was used for cutting turf or sods, and may be so used yet in some places, but in this instance the use was for cultivation purposes—to cut off sods or spits of soil to cover the potatoes planted by an assistant. With this and most of all the other old forms of cultivating implements, the practice was to make a rut in the soil, or to otherwise move it, sufficient to get a cover for the seed, the crop being afterwards kept clear of weeds and in a state of fine surface tilth by repeated and continuous hand-hoeing.

This, indeed, is the practice at the present day in the "unchanging East" and in various uncivilised countries, especially in tropical or sub-tropical climates; and where the work of a man and his family is limited to an acre or half an acre, then it suited well enough, though it is quite impossible under the conditions of modern civilised life.

Some of the reformers of the olden time recognised the deficiency of the plough as a tillage implement, and tried to improve upon it. For instance, Jethro Tull, "the father of drill-husbandry," and a man who wanted to find some way of improving the tilth for the easier use of his corn-drills, hit on the expedient of providing a plough with four coulters which

[1] This sketch, reproduced by permission from 'The Sphere,' London, is thus described in that periodical: "This is not a representation of primitive agriculture in Achill or St Kilda, but an illustration of a scene which took place this year (1904) a little more than a hundred miles from Hyde Park Corner. The breast-plough, as it is called on the Cotswolds, resembles an immense shovel with a share turned up at one edge, and is worked in three successive movements: first, a thrust in from the breast; next, the cross-bar is dropped down to the thighs, which are protected by wooden guards called 'bitters' or 'betters' (*i.e.*, probably 'beaters'), from which a further push is given; finally, the clod gathered on the blade is turned over with a quick movement to the right. The owner of the plough shown in the drawing, now over eighty years of age, remembers as a familiar sight in his boyhood twenty men ploughing abreast in one field. Hardly any one at work to-day can remember to have seen, much less knows how to use, one. There is no doubt that the labour is very severe."

Fig 14 —*The last of the breast ploughs* (See footnote on p 122)

cut the slice of earth into strips before turning it over, thus helping to break the soil up and make it more friable. The improvement, however, did not seem to "catch on" or come into practice, although we now adopt the same principle in the double tail-knife on some digging ploughs.

The idea, or principle of cultivation, is to thoroughly mix and pulverise the particles of soil, so as to expose new surfaces to the weathering agencies and to the chemical reaction of one another, and thus set free another supply of the elements of fertility. There is in an ordinary soil an almost inexhaustible supply of these elements, but it is locked up in the constituent minerals for the most part, and only a small quantity is available in any given season, and it soon becomes exhausted by cropping and requires constant renewal. This renewal may be secured by adding manures, but we are becoming more and more convinced that the cheapest and best way is by cultivation. The more cultivation the better the crops will be within certain limitations, and the developing of cultivating implements is now the order of the day. So much depends on the physical or mechanical condition of the soil that chemical analysis is being abandoned to a great extent, and tests made of the size of the soil particles, the minerals contained, the amount of water held, the height to which water will rise by capillary action, the colour, and so on. In many cases it is possible from these and similar data to predicate what kind and quality of crops a given soil is best suited for, and this is actually now being done by Government officials in the United States.

### *Ploughs and Ploughing.*

Now, ploughing and cultivation of all kinds are intended primarily to help to improve the physical condition of the soil, as well as to make a suitable bed for gettting the seed covered in, and the plough and other implements which do this most satisfactorily are the best to have. For this reason we are not now satisfied with a plough which merely cuts and turns over a furrow-slice of soil, but it must cover in all grass or rubbish, be inverted, and at the same time pulverised as much as possible.

The great agent for pulverising the soil and making a fine tilth is of course frost; no amount of work we could do with implements would equal the work of this agent. But the work of the frost is greatly aided and abetted and made effectual if the soil has been properly ploughed and broken up and left in a state fit to let the frost get well into it. Indeed, the frost by itself would do little or no good, as we can see in an ordinary

uncultivated field. In an average winter the frost will penetrate as far down as the roots of the crops, but on an untilled field this would be of little use. A grass layer, or even a clean stubble, will not be put into a fit state for the growth of the next crop by the frost alone, but it must be turned over and raised up to let the frost get at all parts, and also to give room for the particles to be expanded and loosened up for the better making of the tilth. Practically the implements we use are as much for the purpose of helping on and accentuating the weathering effects of frost and air and rain as for anything else.

A fine tilth is one of the first requisites of arable farming; for apart altogether from the questions of tapping the practically inexhaustible supply of the elements of fertility contained in the soil, or in the minerals and rock fragments forming the soil, there is the question of utilising to the best advantage the manures that we put on. If the soil is not thoroughly worked, then the manures applied do not have so much effect on the crops. Not only does the want of tilth prevent the plants from growing properly, and from sending their root-fibres easily through the soil in search of food, but the want of stirring and aeration hinders the growth of the microbes in the soil, whose business it is to cause the manure to decompose and assume forms or combinations suitable for the use of the plant, and the dressing either lies dead and inert or is wasted when the rain of the next winter descends.

In the ultimate results between ordinary cultivation in the old times and that practised now there is little to choose. Recollecting that the soil is only, say, 6 to 8 inches deep in the majority of cases, we can see that the *Sarcle* in ancient times in hot countries, and the spade with ourselves in more recent times, were as likely to produce a fine tilth as was needful. Indeed, "spade-husbandry" had become proverbial a generation ago for the benefits it conferred on land, and many attempts were made from time to time to so harness steam-power as to increase the scope and power of "spade-work." The modern system of working with horse- or power-driven implements simply resolves itself into doing the work on a larger and cheaper scale, but not doing it any better. In the days when a labourer's wage was a shilling a-day, and he was willing to work for ten hours to the top of his bent for this money, then spade-cultivation was the best; and this was a common method of doing the work in the time of the fathers of the present generation in many parts of the country. Nowadays, however, even if men were plentiful enough, the expense would kill it, and so implements to do the same work are invented and used.

It is a sad thing to say, but it is true, that nothing has helped to spoil ploughing and cultivation so much as ploughing-matches. One would think that the competition among ploughmen would have helped on the improvement of the work, and so it might have done if the proper kind of ploughing had been encouraged. Unfortunately, however, the custom sprung up of cutting an exceedingly small fine furrow-slice with a "false bottom," intended to show an exaggerated "crest" on the finished work. This type of work was carried out to an insane degree in the past, and the land never got a chance to yield its full increase. Further, the man who took a prize at one of these matches very often had a bad attack of swelled head, and considered that he knew everything that was worth knowing about ploughs and ploughing, and could not be told anything or be got to see that the whole system he was following was wrong and sadly in need of improvement.

Perhaps in no way is the difference better shown between the old and the new ideas on ploughing than in a comparison of the plough with a mould-board for "match work" and a plough with the short chilled-steel digging breast. As already stated, the writer believes that ploughing-matches have done a deal of harm in the direction indicated, and the mould-board for match work exemplifies this. It is of extra length and of very gradual slope, the intention being to turn the furrow-slice with great care, so as not even to crack or break it if possible. Nowadays our idea is to crack and break and pulverise as much as possible, and turn the whole upside down to cover in all surface rubbish, and all our ploughs with chilled-steel mould-boards and "digging" mould-boards are designed for this purpose. They are short and wide set and concave, and thus they crush and turn the earth of the slice, while the other is long and convex, and only partly turns without any crushing or breaking at all.

The crested, well-set-up furrow-slice was the method of our fathers; the inverted, broken, or pulverised slice is the method nowadays. In the former case a deep even "nick" was necessary to receive the seed when broadcasted, and to give sufficient soil to cover the seed when harrowed; but now, when we use corn-drills to deposit it with machine regularity, and wish the "tilth" to be well made before seeding, and the harrowing and cultivating to be mostly done previous to the putting of the seed into the ground, the furrow-slice that is crumpled and turned upside down is the one to be most desired. In the former style of work the furrows had to be comparatively narrow, or, at any rate, the width had to bear a certain proportion to the depth; but with the broken inverted slice the width may be as much as the plough can take or the horses

can comfortably pull. The two diagrams (figs. 15 and 16) illustrate the differences between the old and the new ideas on ploughing as a form of cultivation.

The skim-coulter is absolutely indispensable on ploughs of all kinds if good clean work is to be done. It rather destroys the "cresting" where ploughing of this kind is desired, and tends to make the finished land flat; but nowadays, when inverted broken ploughing is desired, the skim is a great help in making a clean job and in doing efficient work. On many of the modern digging or cultivating ploughs the ordinary coulter is omitted altogether, and only the skim runs in front and cuts out a good slice to deposit in the bottom of the furrow, and thus help the work of turning and breaking up by the main breast behind.

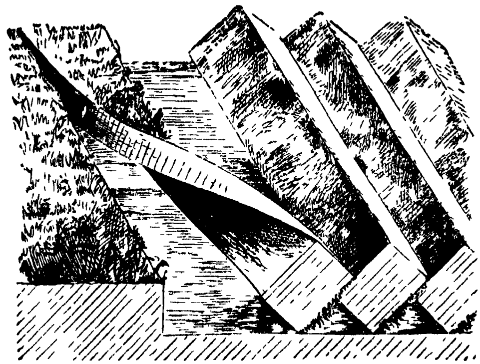


Fig. 15.—*Narrow-crested unbroken furrows.*

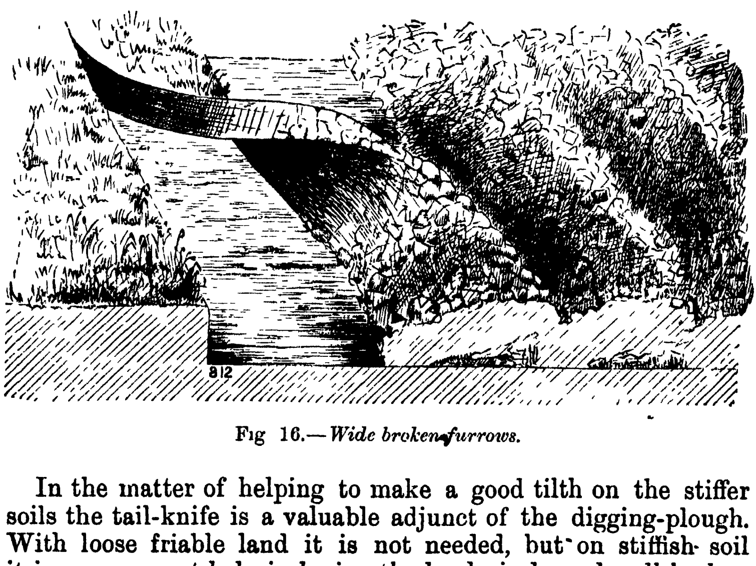


Fig 16.—*Wide broken furrows.*

In the matter of helping to make a good tilth on the stiffer soils the tail-knife is a valuable adjunct of the digging-plough. With loose friable land it is not needed, but on stiffish soil it is a very great help in laying the land nicely and well broken and cut up after the furrow-slice has been turned over; and

thus by exposing to the weather a fine tilth may be ensured. The most approved forms of modern ploughs which do digging, or at least pulverising work, are represented in figs. 17, 18, and

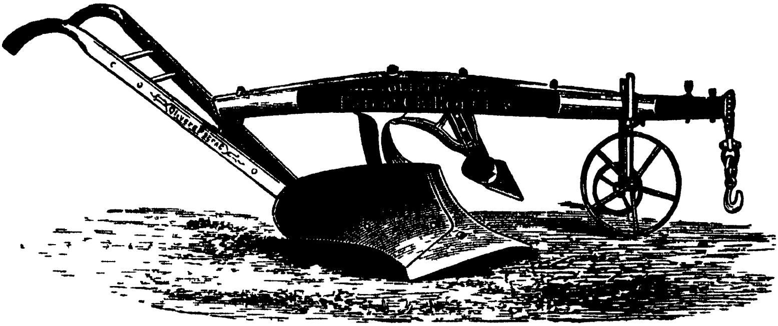


Fig. 17.—*Oliver plough.*

19. Almost all makers now manufacture similar varieties to meet the increased demand for the new form, consequent on the dissatisfaction many feel with the old style of work.

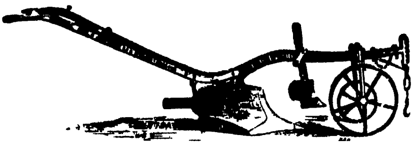


Fig. 18 – *The Ransome steel chill plough.*

The double-furrow or multiple-furrow plough is by many thought to be one of the coming implements. It may be perhaps looked on as somewhat retrograde on the part of the writer to call the use of this plough into question, but various

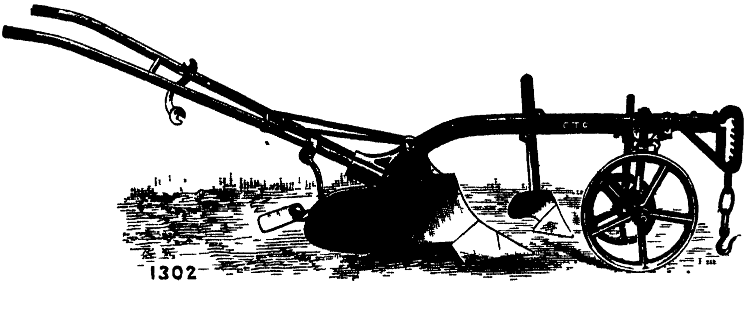



Fig. 19 —*The Hornsby digging plough, with tubular beam.*

things have to be taken into account in this matter. Allowing for the moment that multiple ploughs are the right and proper thing where power can be applied, as by a steam-engine or a

motor, it is rather different where we still work with horses in the old way. It is customary for each ploughman to look after, work, and feed a pair of horses, and if multiple ploughs are introduced, then three or four horses must be put into a gang. This, of course, could be done where it is the custom for one man to feed and clean three or four horses night and morning, as is the custom of the south of England, but in an ordinary "two-horse country" it would be difficult.

On the other hand, there is very little to be gained. In the West, where one man with four horses and a three-furrow plough can turn over five acres per day, the multiple-furrow is all right, but it is questionable if the wide-broken single furrow-slice would not suit our small fields and crooked fences much better at the rate of an acre and a half with two horses and one man per day. You have either to break up another man's pair to get an extra horse or else adopt three-horse farming throughout, and get implements on this style for the other kinds of work on the farm. On the other hand, two-horse implements of all kinds can be had—even cultivators; and the capabilities of two-horse farming have not yet been exhausted, while it is a system particularly applicable to ploughing.

There are, of course, cases where the soil is so loose and friable that two horses could quite well pull a double-furrow plough, each turning an ordinary furrow-slice. In such a case the desirability of adopting the double furrow should be gone into. Yet it may be pointed out that while two furrows worked side by side would probably be each, say, 9 inches wide—a total of 18 inches—a modern chilled-steel digging plough can take 16 inches in one furrow and pulverise the soil at the same time, so that the gain in time or area is not great when all things are considered.

*Wheeled Ploughs.*

Americans have not hesitated to adopt the most modern ideas of utilitarianism in the matter of ploughs. They have no sentimental objections about trying new things. The ordinary old-fashioned ploughman believes in the common swing-plough, and thinks that the mounting of it on a set of wheels is derogatory to his dignity and insulting to his skill. Nowadays we want the most suitable work done in the handiest way, and, content to stop the waste of skill as one of the effete things of our youth, we put wheels on our ploughs so that the ordinary man can do good efficient work with more comfort to himself and less tear and wear upon his horses.

On the other side of the Atlantic farmers have gone much further than this, however, and in the sulky- and gang-ploughs have fitted up the working parts of the implement—the mould-

board, share, and coulter—into a frame of three wheels, surmounted with a seat, so that when once the field is started and the plough set to the work wanted, the ploughman simply sits and drives in the same way as he would do a mowing-machine, lifting the working parts out of the soil at the land-ends, for turning, by means of a lever.

Transatlantic farm papers are full of the illustrations of such ploughs. That they are coming more and more into use out there is no matter for surprise, for they do the maximum of work with the minimum of labour on the part of both man and horses. Of course such a style of plough does not suit small fields, nor when many furrows must be made and left open, as where narrow ridges or "stetches" are the customary style. For large fields, however, or roundabout ploughing, it is a most efficient tool, as will be readily imagined from the illustration in fig. 20.

As already indicated, these American ploughs have seats. It is worth the while of those who like advanced ideas to consider the suitability of seats on some of the ploughs used in this country. On the ordinary swing-plough a seat would of course be impossible, but it is quite suitable for a wheel-plough, as illustrated. The only objection to the presence of a seat is the temperature of the air in winter-time; it may be so cold when ploughing that the man would prefer to walk and hold a plough in the ordinary way, so as to keep himself comfortable. Apart from this, the use of a seat is a decided improvement where feasible.

The principle of digging or pulverising and mixing the soil has led to many devices being tried. One of the best of recent years is just being introduced into this country from America. This is the disc-plough, in which a revolving concave disc or bowl of steel takes the place of the mould-board and also of the coulter. The accompanying illustrations (figs. 21 and 22) give an idea of the type. There is an immense number of varieties of this plough in use in the States, from the single disc for two horses, or the double disc for three, up to a combination of thirty or forty discs, drawn by a powerful traction ploughing engine.

This plough is very easy to pull, for the revolving disc lessens the friction immensely, on the principle that a wheeled vehicle has less resistance than a sleigh. At the same time the concavity of the disc, and the angle at which it is set, have the same pulverising and inverting action as the digging-plough. The edge of the revolving disc cuts its own way through the soil in much the same manner as a wheel-coulter would do, thus lessening the friction in this respect. On such ploughs for use here, however, it will be necessary to fix an ordinary skim-coulter, so as to pare off the edge of the furrow-

slice in front, and thus have the main body of the soil turned over and pulverised without any ragged edges of vegetation showing up.

There is one system of ploughing that is largely practised in America and might be tried here: indeed, the writer means to have a try, if he even does his own ploughing all himself as

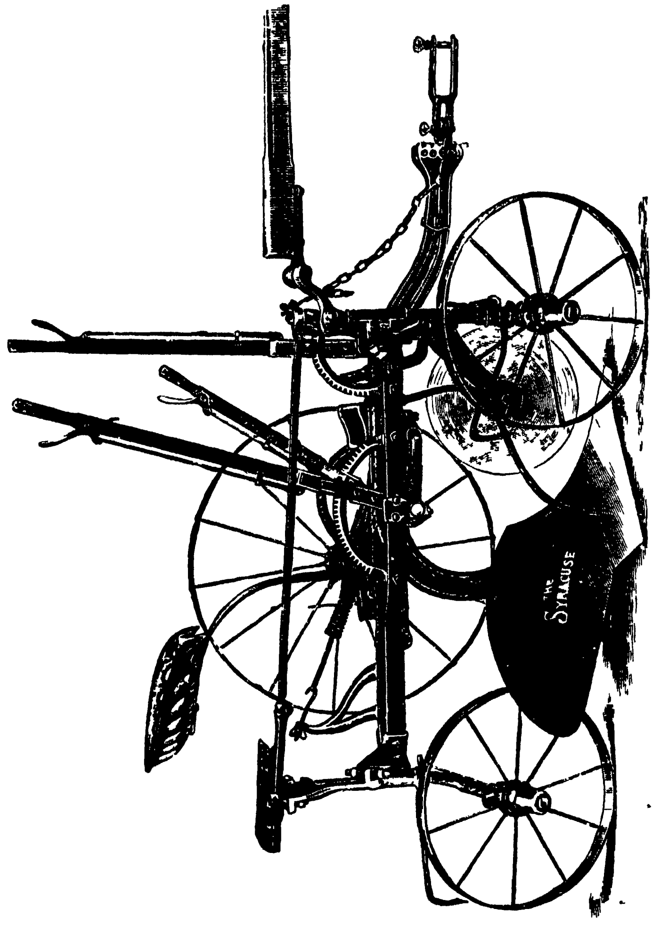


Fig. 20.—*American sulky plough.*

soon as he has an opportunity. This is simply ploughing round a field in a continuous furrow and finishing in the centre, or conversely, beginning in the centre and ploughing round and round until the fence is reached. If one just stops to think of it, what an unbounded nuisance the ordinary system of ploughing a field is! The land has to be "drawn off"—sometimes by

actually surveying with a chain; the "crowns" have to be made with the greatest care and skill, while there is an everlasting waste of time in turning out and in at the land-ends.

In the district in which the writer lives the making of a

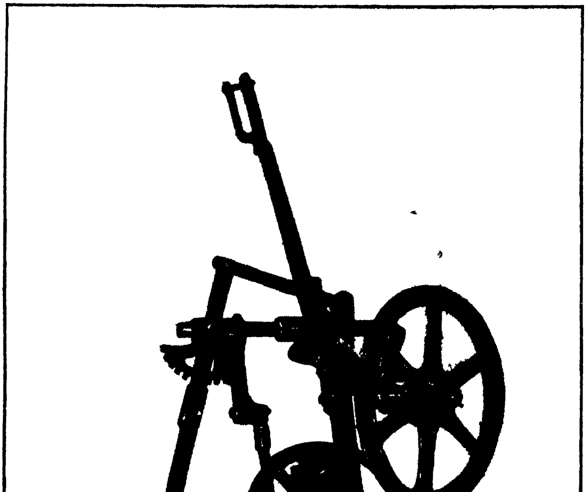


Fig. 21.—American disc plough, single furrow.

crown out of the level ground is absolutely unknown; two furrow pieces have to be ploughed out so as to make a hollow, and one of these is either carted away or "chucked" over the untouched land. Now all this nonsensical system of working is done away with when a field is ploughed spirally in one continuous furrow.

The presence of open furrows is a doubtful advantage in these days of string-binders and other labour-saving machinery, and is entirely done away with by this new (yet old) system. Where furrows are needed to carry off the water, then a few

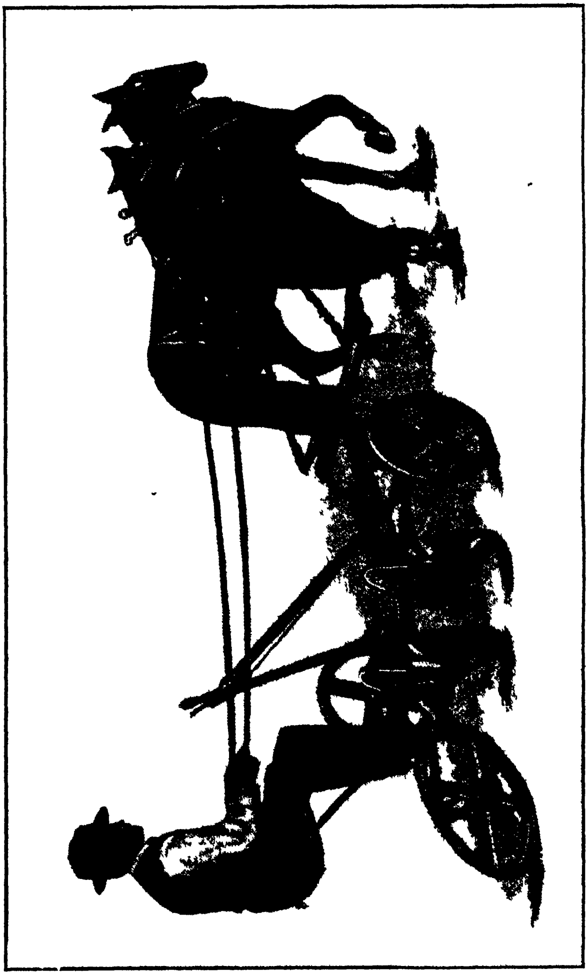


Fig 22 —American disc plough, double furrow.

water-furrows in the hollows would be sufficient, excepting on the heaviest lands.

The turning at the corners can easily be negotiated, while the breathing spell necessary for the horses can also be given at these. The ploughing can be done round and round until a piece no bigger than a kitchen-table is left in the middle, and

this can be dug over. If it is not desired to trample over the ploughed land in going and coming, then a roadway can be left from the gate to the middle of the field and ploughed last, or a "headland" left for turning on at each corner, to be afterwards separately ploughed.

### *The Harrow.*

The first harrow ever used was the branch of a tree, which the first user "haurled at his curpin." When the use of the harrow became more extensive it was fastened to the tail of a horse, and the poor "garron" had to pull it the best way he could. The wearing away of the twigs, leaving the bare hard points of the branch, suggested to the next reformer the benefits of using hard pegs fastened into a frame, and later on the substitution of iron "teeth", and this latter remained the type of the harrow for centuries. It was absolutely the only kind in use until a generation ago. The modern iron frame harrow is comparatively a recent innovation, while the various forms of harrows and surface cultivators now in use have almost all been evolved within the last five-and-twenty years.

The old wooden forms are by no means extinct yet, and are often to be met with in many parts of the country—especially in the "drag-harrow" form; while in many of the hay-growing districts of the south of England the bush- or brush-harrow is of universal use yet for dressing meadows—a survival from the times of our prehistoric ancestors—in spite of the better results obtained by the use of a chain-harrow fitted with fore-scraper.

One of the modern improvements in harrows is the invention and adoption of the spring-tooth. This has no doubt been a great advance, but it is not as great as it might have been. One of the drawbacks in the actual work of harrowing is the liability of the teeth to gather rubbish and to become blocked up, and so require a stoppage for cleaning purposes. If the land has a lot of rubbish on the surface the number of acres gone over in a day may be seriously reduced. When the land is dry, a smart man with a hooked stick may hitch up his harrows clear of their load of rubbish as they drag along—a leaf at a time; but men willing to be smart enough at this work are becoming scarcer every year, and so now we have to look out for another way of obtaining the same end. This is supplied by the adoption of the spring-tooth on the implement.

The substitution of this tooth for the straight rigid tine enables us to harrow land with a deal of rubbish on the surface without any trouble. The spring-tooth yields backwards and forwards in a jerking dancing motion as the implement is pulled along, and this not only helps in the pulverising, raking action of the harrow, but also prevents the gathering of weeds

or rubbish on the tines. The defect of these spring-tines is that they are generally not made stiff or strong enough to "bite" the earth as well as the old-fashioned rigid type— a defect which might quite easily be remedied.

Perhaps the arrangement which is best of all is the adjustable rigid tooth with a spring-set handle. The tines are of one thickness throughout, and fastened to the frame by shackles. They can be pointed backwards, forwards, or perpendicularly. This means that the same set of harrows can be made to bite almost as much as the old drag-harrow, or to work as lightly as a set of grass-seed harrows or a chain-harrow. Also, it means that at the land-end any rubbish which tends to choke up the tines can instantly be got rid of by setting them backwards and moving the whole forward for a yard or two, when the rubbish immediately slips off. The handle which controls each leaf has a spring setting, so that though the whole is to a certain extent rigid, yet it "gives" a little to a stone or other obstruction.

Again, this form of harrow is or can be always fitted with wheels or sliders and a seat, so that, as far as we understand anything about the best way of harrowing land and the best harrow to do it with, these later forms have almost everything one can desire.

Harrows have been successfully fitted with wheels, but a drawback to the use of these is their smallness. There is not room to use ones of large diameter, while on rough or lumpy ground the small wheel does not run so steadily as a large one.

In other designs of harrows there are runners or sleigh-irons fitted on, whereby the depth of working can be regulated. Concurrently with the use of wheels or sleigh-irons, there are handles fitted on with gear for raising or lowering the tines. By this means the harrows, when being moved from field to field, do not require to be taken to pieces, but are simply shifted along as they sit in use by having the tines raised up out of the ground.

Harrows with these improvements are of course made with only two leaves; the old three- to five-leaved varieties are not so suitable for these modifications. A two-leaved harrow, again, can be fitted with a seat for the driver, so that with the implement set to a certain depth and the weight of the man on top, the work is more regularly done.

In some cases, however, the seat is carried on a frame behind, as in fig. 23, and the frame, in its turn, on two wheels, so that the gauging of depth, the steadiness of wheels, and a seat for the driver are all secured.

One cultivating implement which one does not see much in this country, but which is largely in use in America, is the disc-

harrow, an improved form of which is here illustrated (fig. 24). It practically consists of a series of discs set in a frame in such a way and at such angles as give great cutting, tearing, and pulverising power to the implement. It is said that no implement covers in the seed so well when it is broadcasted on the furrow; and, accordingly, it is now made combined with a seeder on the top, which drops the seed broadcast in front while the discs follow and cover it in.

A noticeable point is the size of the discs. As a question in the mechanics of draught, it can be easily shown that the larger the discs the more easily will the horses pull the implement; but, on the other hand, the larger the discs the less will they penetrate the soil, a point that is often overlooked. The smaller the discs the deeper will they cut into the ground, and the heavier will the draught be for the horses. The average has therefore to be struck between the two antagonistic conditions, and a disc of 16 inches diameter is the standard now fixed on. As there are usually sixteen discs in the whole implement—eight in each wing—the sixteen discs of 16 inches diameter is known to Americans as the "Sixteen-sixteen," and in this form is a standard implement which might with advantage be more used here than it is. The fixing of each disc in its own spring setting enables it to work on stony or rocky land where the fixed spindle would not be so satisfactory.

### *Cultivators.*

With cultivators more than with harrows the greatest modern improvement has been the introduction of the spring-tooth. This, like many of our other improvements, was introduced from the other side of the Atlantic, but did not succeed in the form in which it was first used. The ordinary flexible spring-tooth turned out to be too slim for ordinary cultivation, and could only in reality do the work of a good harrow; but the adoption of the principle was followed by good results, and now our best cultivators have rigid teeth, but the frame or setting is a spring, or includes a spring, so that while the tine will keep well into the soil and do its work thoroughly, it at the same time has the shocks from stones or hard pieces of soil much eased by the spring action. The two favourite forms of this implement on the market at present are here shown (figs. 25 and 26), but as now made they are combined implements suited to a variety of operations in the shape of land-ridgers, side-hoes, drill-grubbers, and so on,—a great advance within the last ten years. Indeed, the last half-dozen years or so have seen an immense revolution in the development of our horse-hoes, side-hoes, scufflers, and other implements of that kind. Perhaps the most

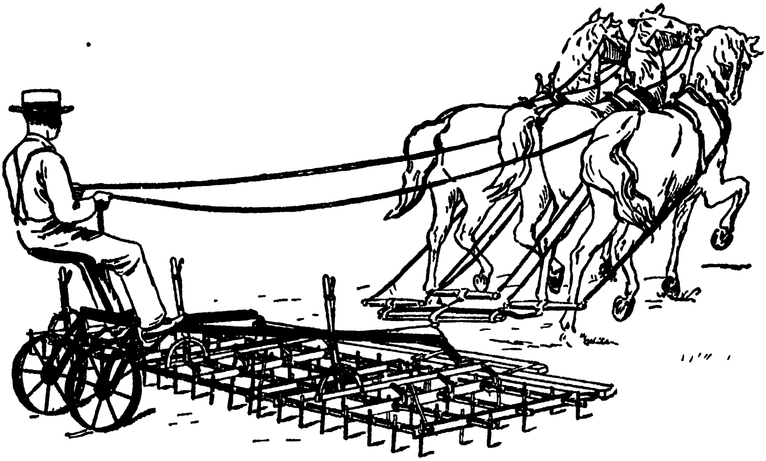


Fig. 23.—*American harrow, with seat for driver.*

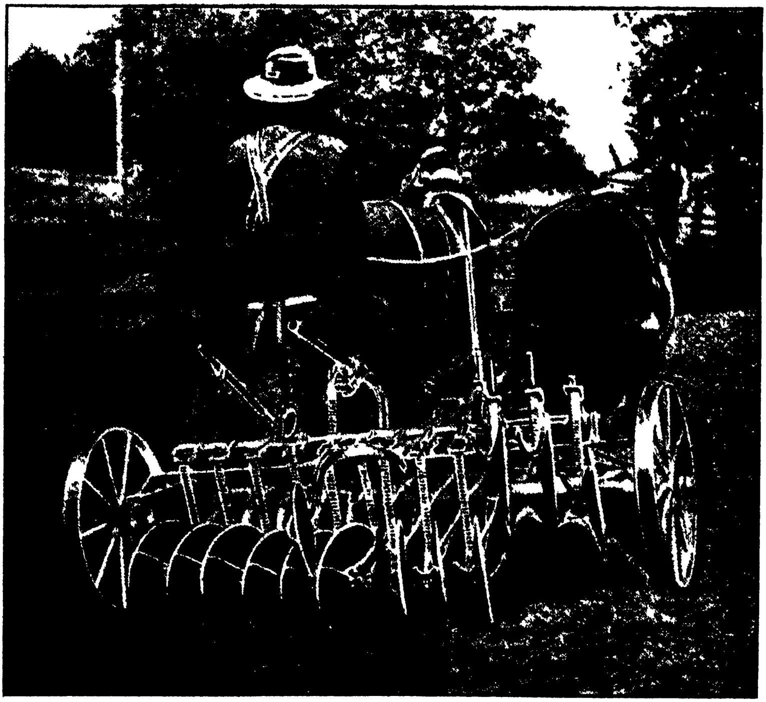


Fig. 24.—*American disc-harrow.*

important type of improvement has been the adaptation of the framework of the ordinary cultivator to take tines or blades in sufficient numbers to do three balks or ridges at once with two horses.

This is an immense advance since the days when a man with

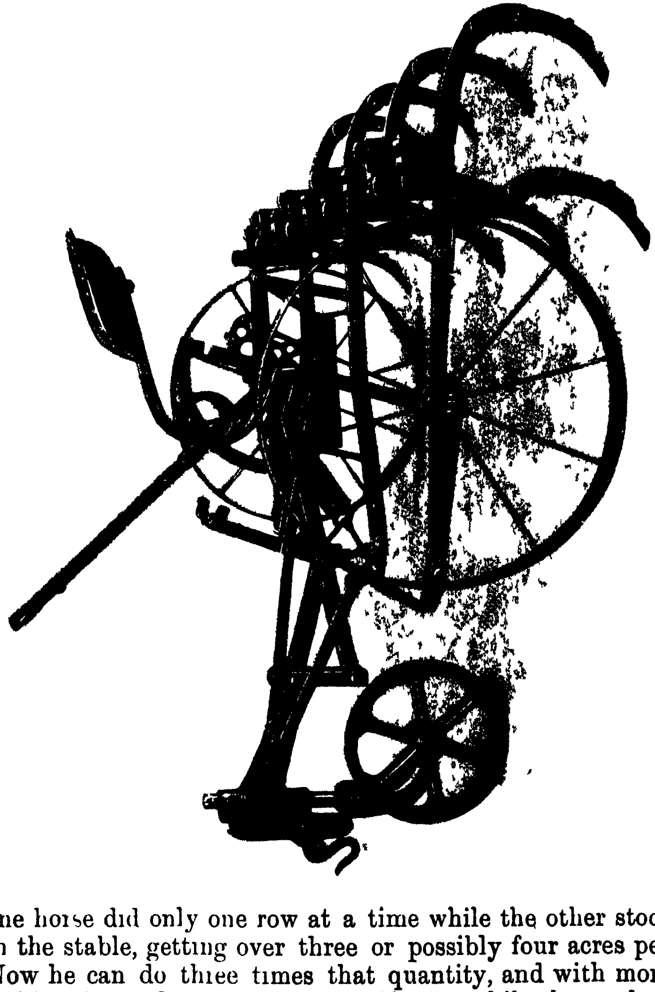


Fig 25 —*Larkworthy's cultivator.*

one horse did only one row at a time while the other stood idle in the stable, getting over three or possibly four acres per day. Now he can do three times that quantity, and with more ease to himself, as there is a seat to ride on, while the work can be still further expedited on some soils by having three sets of double mould-boards fixed on behind the scarifying tines, to

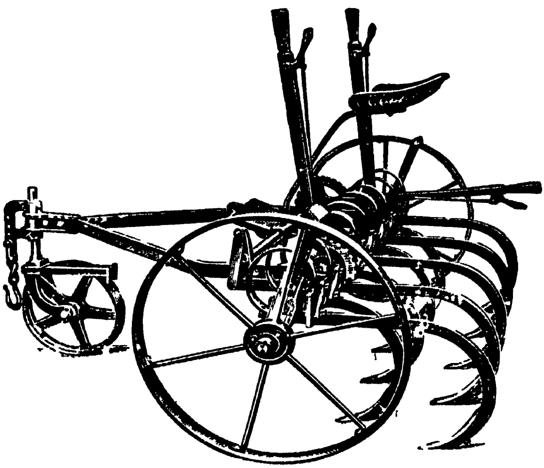


Fig 26.—*Martin's cultivator*

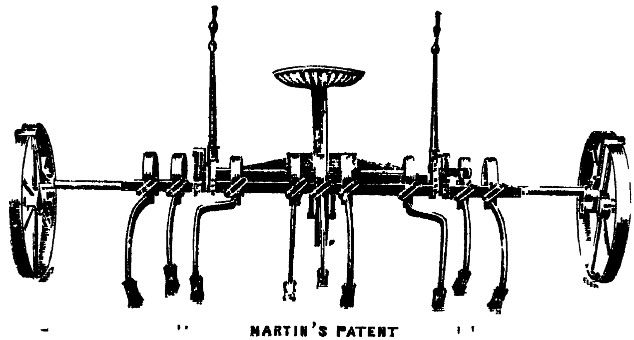



Fig 27.—*Martin's combined cultivator, arranged for hoeing*

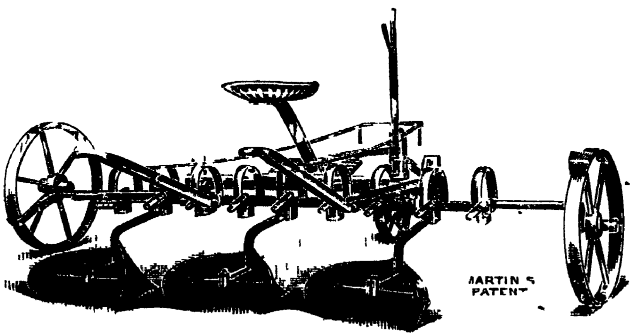



Fig. 28.—*Martin's combined cultivator, arranged for earthing up*

earth-up and finish off as the work goes on. The illustrations in figs. 27 and 28 show the adaptation of one of our most popular cultivators to the hoeing of three rows of roots at one stroke, or the earthing-up of three in a similar manner.

### *Steam Digger.*

Of modern cultivators on a giant scale, mention must be made of Darby's Digger (fig. 29), much used in the county the writer farms in. This is one of the most recent evolutions of cultivating the land by steam, and is a digger no longer but a stirrer and subsoiler. The stirring apparatus is a triangular arrangement fixed on behind an ordinary traction-engine and worked by the same, and carried about by it while in work.

Fig. 29.—*The Darby steam digger.*

A series of revolving tines are fixed to work perpendicularly along each wing, and when in work these penetrate the soil to any required depth, say up to 10 inches, and revolving perpendicularly as the whole moves along, stir up and mix the soil thoroughly. The soil is not only stirred up, but the subsoil as well, and this without disturbing their relative positions, while the vegetable rubbish still remains on the top. The ground is thus thoroughly broken up, subsoiled, and aerated; but the work has of course its limitations. This implement would not do on rocky ground, nor even on soil full of stones or boulders. It is of most use on dense clay soils, but of course these must be in a fairly dry condition to benefit by the pulverising action, and the work is best done as a preliminary to fallowing or fallow cropping, unless the ground is very clean and free from weeds.

*Motors.*

One cannot help thinking on the wide space of time and invention which separates a huge cultivating implement like the Steam Digger and the *Sarcle* of the farmer of the early ages. In order to keep abreast of the times the makers of this implement are adapting it to work on a smaller scale with a petrol or petroleum motor—that is, a motor will be prepared suitable to drive any kind of farm implement, and on to which the digging arrangement can be hitched at short notice, thus reducing the weight from the many tons of a traction-engine to the few tons of a motor.

The use of motors in the work of cultivation is one of the new movements of the twentieth century. Up till the present time the attempt is only in the experimental and transition stage, and the writer cannot say much on the subject. It is certain that motor farming, however, is bound to come sooner or later, for we cannot expect that farming will be the only business left out in the cold when all other departments of human labour have been developed by the use of cheap motive power in one form or another. On the other hand, there remains the fact that the steam-engine as a motive power for field work has been largely a failure, and it is difficult to see how petrol or electricity or any other motive power is going to do better. Forty or fifty years ago the steam-plough was booming, and people then thought that a new era had set in for farming, but to-day the steam-plough is not much used, though the cultivator is in demand. If it had been possible to cultivate the soil to, say, 2 feet deep, then the steam-plough would have been a success, because a mighty engine could have been tackled on to a mighty plough—as they do on some of the sugar plantations now—and the land ripped up to any depth. Unfortunately, the cultivatable part of the soil is limited to a few inches downwards, and two to three horses can pull a plough set at the greatest depth that is practicable or advantageous, while the horses are much more handy and convenient than the ponderous engines necessary for the work. The attachment of a larger number of ploughs, so as to utilise the power of an engine in the breadth of the work instead of the depth, did not suit our small British fields and contracted ideas of labour, though this system has been a splendid success on the great plains of the West, as the adjoining view will illustrate (fig. 30).

Now the motor work is being developed on another system, and there is more chance of success,—that of reducing the size to suit the size of our fields and our ordinary implements,—and the probability is that by adapting com-

bined implements to the motor there will be some chance of success.

One point strikes the writer very forcibly, however, in connection with the published horse-power of the motors now on the market, and that is the excess of "horse-power" over the number of actual horses required to do the same work. For instance, one motor is advertised as of 18 horse-power. Now, the engineer's horse-power is one-half more than that of an actual average horse—owing to the mistake Watt made in his experiments and calculations when he first invented the steam-engine—so that 18 horse-power on an engine means equal to twenty-seven actual horses. But this powerful motor only pulls a three-furrow plough or two string binders, work which could be easily accomplished by, say, six good Clydesdale draught horses. From this one must naturally conclude that there is a tremendous waste of power either in moving the motor itself or in some other way

Of course the real test is the adaptability of the motor to the various farm operations, and the total cost of the work. If the cost of buying and running a motor comes out less than the cost of buying and keeping horses to do any given piece of work, or all the work of a farm, then this is so much in favour of the motor, irrespective of the declared horse-power, and in any case there is likely to be development and improvement as the time goes on. As a farmer with engineering tastes, the writer will welcome the success of the motor, and this all the more that it does not seem to be going to do away with horses or affect their price. People in the olden times expected that railways would do away with horses altogether, whereas the number of horses required increased immensely with the extension of railways, and that may probably be the result in this case. At any rate, the present state of the horse market does not show any tendency to a reduction of prices, as any one can find for himself if he goes to buy, as the writer has lately experienced.

At the time of writing, the most modern and adaptable motor seems to be the one which is practically contained on the two fore-wheels of a carriage, with a third detachable one for putting on to carry the motor when not at work. When at work it is hitched on to the implement to be pulled, so that it practically supplies the two fore (steerage) wheels, and thus the motor and the implement form part of one machine, as it were—much handier for traction and turning at the land-ends—and it is probable that the successful motor-plough or cultivator of the future will be with some device of this kind.

As this article began by stating that the last ten years had seen immense improvements in our ideas on the cultivation of

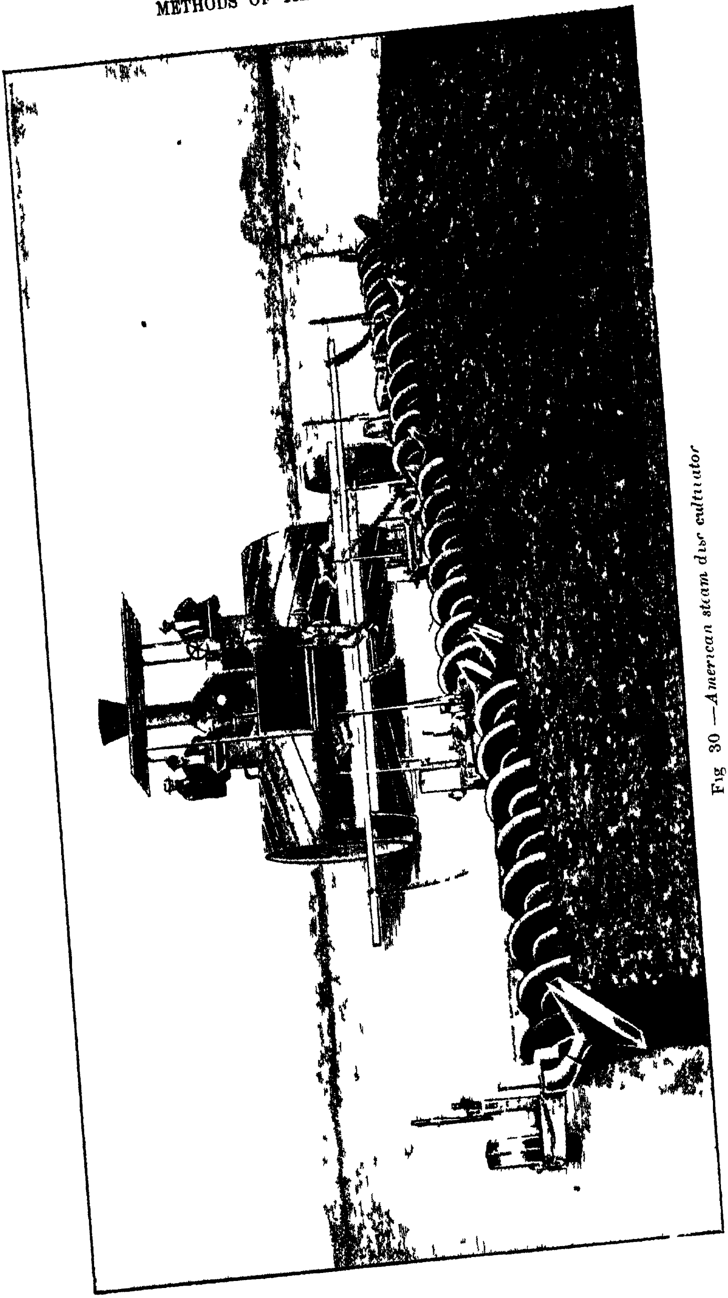


Fig 30 —*American steam disc cultivator*

land and in the implements to do the work, it is an easy prophecy to foretell that the next ten years will see even greater improvements still, for development seems to proceed in a geometrical ratio. Land will be cultivated more and more thoroughly as time goes on. At one time farmers were satisfied with simply ploughing a common furrow, scattering the seed by hand and harrowing in. Now we "cultivate" the soil in every operation from the moment that the point of the ploughshare enters the ground, and the implements to do this with are ever being improved and combined, while the development of various forms of motive power will likely work many revolutions within the next few years. The writer, as he has already stated, is a great believer in two-horse work and two-horse implements, and can see room for much development yet in this direction, but undoubtedly the next ten years will witness progress in these matters in many ways.

---

## CLAIMS UNDER THE AGRICULTURAL HOLDINGS (SCOTLAND) ACTS, 1883-1900.

By JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.

TWENTY-ONE years have come and gone since it became law that "a tenant who has made on his holding any improvement specified in the schedule, shall, on quitting his holding at the determination of his tenancy, be entitled to obtain from the landlord, as compensation for the improvement, such sum as fairly represents the value of the improvement to an incoming tenant." Previous to 1884 the presumption in law was against the tenant and in favour of the landlord, and the whole improvements passed to the latter without payment therefor.

Notwithstanding the considerable period during which the Act has been in operation, the average tenant farmer has not, as a rule, made himself conversant with its provisions, or with the procedure to be followed when he wishes to take advantage of it, on "quitting his holding at the determination of his tenancy." This is hardly to be wondered at when we consider the various amending Acts which have been passed since 1883, repealing, altering, and adding to the provisions and procedure of the original Act, the interpretation of which presents many difficulties even to a legal expert. Several most useful handbooks have been published explaining the meaning and working of the Act, but even these contain many legal technicalities which

a farmer requiring to consult them, perhaps once in a lifetime, can scarcely be expected to grasp. The Board of Agriculture promised in 1900 to pass a consolidating Act for Scotland embodying the provisions of the preceding Acts, and it would undoubtedly have been advantageous to all concerned if this had been carried into effect. In the absence of the promised Act the writer will now endeavour to state, as clearly and concisely as possible, some of the points on which those making up a claim are likely to require information.

### *Notice of Termination of Tenancy.*

Where either the landlord or tenant intends, on the expiry of a lease, to bring the tenancy to an end, it is necessary that written notice be given by either party to the other of his intention; failing such notice by either party, the lease shall be held to be renewed by tacit relocation for another year, and thereafter from year to year. Such notices should be given by registered letter addressed to the landlord, factor, or tenant, as the case may be, and posted in time to be delivered before the expiry of the time prescribed—viz., (1) In the case of leases for three years and upwards, not less than one year, nor more than two years, before the termination of the lease; (2) In the case of leases from year to year, or for any other less period than three years, not less than six months before the termination of the lease. (See Act of 1883, sec. 28.)

### *Lodging of Claim.*

Under the Act of 1883 the tenant was bound to give notice in writing to the landlord of his *intention* to make a claim for compensation; but this section has been repealed and the following substituted in the Act of 1900: "Any claim by a tenant for compensation . . . in respect of any improvement . . . shall not be made after the *determination of the tenancy*." The meaning of the preceding four words has given rise to much litigation, but the point has now been definitely settled as follows: (1) Where the entry and ish are at Whitsunday as to houses, grass, and fallow, and at the separation of the growing crop as to the arable land—*held* that Martinmas following the separation of the away-going crop was the determination (*Black* v. *Clay*, 1893, House of Lords). (2) Where the tenancy terminated at Martinmas as to the arable land, and at the Whitsunday following as to the houses and grass—*held* that the following Whitsunday was the determination (*Strang* v. *Stuart*, 1887, Court of Session).

It is safe to lodge the claim before 15th May or 11th

November, specifying at least the amount claimed; but it is advisable to give particulars along with the claim, so far as practicable, to enable the landlord to judge of its reasonableness or the reverse, with a view to its settlement by mutual agreement. There is, however, a provision which must not be overlooked—viz., "Provided that where the claim relates to an improvement executed after the determination of the tenancy, but while the tenant remains lawfully in occupation of part of the holding, the claim may be made any time before the tenant quits that part" (Act of 1900, sec. 2 (2)).

There still remains to be noticed an important provision in the Act of 1900, evidently intended as a cheap and effectual means of settling all or any questions for which either the landlord or the tenant thinks he has a claim against the other party in respect of the holding. It is as follows: "Where any claim by a tenant for compensation in respect of any improvement comprised in the First Schedule to this Act is referred to arbitration, and any sum is claimed to be due to the tenant from the landlord in respect of any breach of contract or otherwise in respect of the holding, or to the landlord from the tenant in respect of any deterioration wrongfully committed or permitted by the tenant, or in respect of breach of contract or otherwise in respect of the holding, the party claiming such sum may, if he thinks fit, by written notice to the other party, given by registered letter or otherwise, not later than seven days after the appointment of the arbiter or arbiters, require that the arbitration shall extend to the determination of the further claim, and thereupon the provisions of this section with respect to arbitration shall apply accordingly, and any sum awarded to be paid by the landlord or tenant shall be recoverable in manner provided by the principal Act for the recovery of compensation."

It is to be specially noted that if a further claim is made, notice must be given by the party making it within seven days after the appointment of the arbiter, as failing such notice the further claim does not come within the scope of the arbitration; but neglect to give notice does not affect the common law rights of the parties. This clause has been framed to have a very far-reaching effect; in fact, it may be held to extend to every conceivable question arising between the landlord and tenant for deterioration, breach of contract, *or otherwise;* and the claimant may in his option, by giving written notice, require that it shall be settled by the arbiter. By the Act of 1900, sec. 2 (5), it is provided that "an arbitration shall, unless the parties otherwise agree, be before a single arbiter," and if they differ as to the person to be nominated, the appointment, on the application in writing by either of the parties, shall be made by the Board of Agriculture.

*Making up the Claim.*

The claim should state the date and cost of each separate improvement, and vouchers should be produced for the latter. The most convenient method is to state each year's expenditure on manures, feeding-stuffs, &c., as from, say, March 1 (seed-time) to the same date in the following year, giving the number of crops grown after these were applied to the land, thus facilitating the calculation of the "unexhausted value." A draft form of claim drawn up on this method is appended. In this the figures are only to be taken as illustrating a convenient form, and not as fixing the value on the improvement where a certain number of crops have been grown, after application of the manures, as in arriving at this there has to be taken into consideration the whole circumstance of each case, such as climate, the nature of the soil, the sale of crops, high farming or the reverse throughout the tenancy, &c.

No definite time is fixed by the Act in which any improvement is held to be exhausted; it is therefore competent to go back as far as the claimant thinks he can satisfy the landlord, or failing him, an arbiter, that the unexhausted value to an incoming tenant extends. There are several tables showing the duration of improvements drawn up by practical and scientific authorities, which will be found useful to those requiring information on this point.

A claim is competent only for improvements "comprised in the first schedule to the Act," and no compensation can be recovered for any improvements not specified therein, although they may have added to the value of the holding; but if a *further* claim is lodged either by the landlord or tenant, it may embrace any matter connected with the tenancy.

An important alteration of the law regarding penal rents is made by the Act of 1900, sec. 6, which provides that, "notwithstanding any provision in a contract of tenancy making the tenant liable to pay a higher rent or other liquidated damages in the event of any breach or non-fulfilment of a covenant or condition, a landlord shall not be entitled to recover . . . any sum in excess of the damage actually suffered by him in consequence of such breach." This section, however, does not apply to any covenant against breaking up permanent pasture, cutting or injuring trees, or burning of heather.

In conclusion, the writer recommends that claims by either party should be framed on strictly reasonable terms, and that a tender be made to settle by mutual agreement, bearing in mind that this is an important element when the arbiter proceeds to award the expenses.

## AGRICULTURAL HOLDINGS (SCOTLAND) ACTS, 1883-1900.

PARTICULARS OF CLAIM BY A B, TENANT, AGAINST C D, LANDLORD, OF THE HOLDING OF E., 14*th May* 1904.

| | | Tons | Cwt | Quarters | Cost per ton. | Crops grown. | Total cost | Unexhausted value | Amount claimed |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | £ s. d. | £ s. d. | £ s d. |
| | 1. *Purchased Manures.* | | | | | | | | |
| 1904. Mar. 1 | A. B & Co., Bone-meal | 20 | 10 | 0 | 120s. | 1 | 123 0 0 | 60 0 0 | |
| April 1 | A. B. & Co., Peruvian guano . . . | 10 | 0 | 0 | 160s. | 1 | 80 0 0 | 30 0 0 | |
| | | | | | | | | | 90 0 0 |
| 1903. Mar. 1 | A. B. & Co., Dissolved bones . . . | 15 | 0 | 0 | 120s. | 2 | 90 0 0 | 20 0 0 | |
| May 1 | A. B. & Co., Superphosphates . . | 10 | 0 | 0 | 50s. | [illegible] | 25 0 0 | 10 0 0 | |
| | | | | | | | | | 30 0 0 |
| | II. *Feeding Stuffs.* | | | | | | | | |
| 1903. April 1 | A. B. & Co., Cotton-cake . . . | 10 | 0 | 0 | 100s. | 1 | 50 0 0 | 10 0 0 | |
| April 10 | A. B. & Co., Linseed-cake . . . | 5 | 0 | 0 | 160s. | 1 | 40 0 0 | 7 0 0 | |
| | | | | | | | | | 17 0 0 |
| | III. *Lime.* | | | | | | | | |
| 1900. Jan. 15 | A. B. & Co., Lime . | 50 | 0 | 0 | 14s. | 5 | 35 0 0 | 16 0 0 | |
| 1901. Feb. 1 | A. B. & Co., Lime . | 20 | 0 | 0 | 14s. | 4 | 14 0 0 | 7 10 0 | |
| | | | | | | | | | 23 10 0 |

Total amount of claim, . . . £160 10 0

---

# LOST FERTILITY: THE PRODUCTION AND LOSS OF NITRATES IN THE SOIL.

By ROBERT WARINGTON, M.A., F.R.S., Harpenden, Herts.

THE object of the present paper is to bring together and discuss some of the results of the Rothamsted investigations as to the quantities of nitrates which pass, under various circumstances, into our agricultural subsoils, or fail in other ways to contribute

to the fertility of the land. The investigations in question have been published at various times during the last twenty years. The most recent publication occurred in the lectures delivered by Dr Bernard Dyer in America in 1900, under the provisions of the Lawes' Agricultural Trust, and published by the United States Department of Agriculture in 1902. These lectures deal comprehensively with all the investigations made on the soils and subsoils of the experimental fields at Rothamsted, and include much new matter. As these lectures have received very little notice in this country, the results I shall be able to quote from them will probably be new to a majority of my readers.

If an accurate account is taken of the nitrogenous manure applied to any field during a series of years, and also of the nitrogen removed in the crops during the same period, it is found that the *increase* of produce due to the manure applied does not contain the whole of the nitrogen supplied in the manure, but a great deal less than this quantity. If we make the experiment more complete by analysing the soil both at the beginning and end of the trial, we may find that the surface-soil has gained somewhat in nitrogen as a result of the manuring, but even this gain will fail to make up the deficiency observed, and it will consequently appear that a more or less serious loss of nitrogen in some form or other has taken place.

Where heavy dressings of farmyard manure have been applied to the land it is very possible that the losses of the nitrogen contained in the manure may be largely due to fermentive changes of the organic matter in the soil. This part of the question sadly needs further study ; it lies, however, outside the scope of the present paper: we shall confine ourselves now to the losses occurring in the form of nitrates. We turn in the first place to the

## Evidence given by the Crops.

### 1. *Wheat and Barley.*

It is generally agreed that no compensation is due to an outgoing tenant for any residue of nitrate of soda, or sulphate of ammonia, applied by him to the land in the last year of his tenancy. It is considered that the practical effect of these manures is confined to the season of their application, and that no benefit is to be expected from anything remaining in the soil the following season. This opinion is undoubtedly based on common experience. The chemist, however, knows that an average crop does not contain at harvest all the nitrogen

supplied by the nitrate of soda or sulphate of ammonia. He knows also that if heavy rain follows after the application of these manures, the nitrate of soda, and the nitrate formed out of the sulphate of ammonia in the soil, may be carried into the subsoil by the water percolating through the land. It is also equally true that in a very dry hot summer the manures just named may be of little service to the crop, and after such a summer a considerable residue of nitrates may lie unused in the surface soil. It would appear, therefore, that some residue of the nitrate of the manure must frequently remain, either in the soil or in the subsoil, after an application of nitrate of soda or sulphate of ammonia, and it would seem not improbable that a following crop may be benefited by this residue.

The crop following one which has been manured may also be benefited in another way. The preceding manured crop was probably considerably more bulky than it would have been if left unmanured: even, therefore, if the whole of the soluble manure applied to it had disappeared, the land would be enriched by the greater mass of stubble, fallen leaves, and roots left by the luxuriant crop which had grown upon it. This residue of vegetable matter will decay in the soil, and its nitrogen will in due course be converted into a nitrate and feed the succeeding crop. This indirect supply of nitrogen from a previous dressing of manure is one of the commonest ways in which a further benefit is obtained from such a dressing.

There appears, then, to be abundant reason for expecting that crops should sometimes be distinctly benefited by the nitrate or ammonia salts applied in the preceding year.

In the field at Rothamsted devoted to the continuous growth of wheat, two plots (17 and 18) receive 400 lb. of ammonia salts alternately; the effect of the residue of a previous year's manuring is thus annually ascertained. These experiments have continued so long (over fifty years) that their general result is probably known to most of our readers. Although the average increase from the last year's dressing of ammonia salts is, in this case, only about one-quarter of a bushel, there are a few years in which the effect is much greater. It will help us to understand the subject if we look carefully at those instances in which a residue of nitrate was distinctly beneficial to the succeeding crop. The principal facts necessary for this discussion will be found in the following table:—

SELECTED RESULTS SHOWING THE SUBSEQUENT EFFECT OF LAST YEAR'S DRESSING OF AMMONIA SALTS TO WHEAT AT ROTHAMSTED (PLOTS 17 AND 18).

| | Excess of second crop after ammonia | Character of season | | Crop and rain of preceding season | | |
|---|---|---|---|---|---|---|
| | | Crop with ammonia | Rain April to July | Crop with ammonia | Rainfall | |
| | | | | | April to July | August to March |
| | bushels | bushels | inches | bushels | inches | inches |
| Average* | 0·3 | 30·3 | 9·0 | 30·3 | 9·0 | 19·6 |
| 1894 | 4·9 | 37·1 | 8·2 | 20·4 | 5·5 | 20·1 |
| 1871 | 4·1 | 28·4 | 11·7 | 34·3 | 3·9 | 16·7 |
| 1890 | 3·8 | 41·5 | 9·7 | 23·4 | 14·5 | 17·5 |
| 1891 | 3·1 | 31·8 | 9·2 | 41·5 | 9·7 | 12·7 |
| 1882 | 3·1 | 31·0 | 12·0 | 32·0 | 5·8 | 24·1 |

* The average crop is calculated on a period of 52 years, the average rainfall represents 26 years.

The figures in the table show that while a dressing of 400 lb. of ammonia salts per acre produced an average increase in the year after its application of only 0·3 bushel, yet in the year 1894 the subsequent effect of such a dressing reached 4·9 bushels. To understand this special result we must look first at the circumstances of the previous season when the ammonia salts were applied. The table shows that the previous season had a very dry summer, the rainfall in the four months, April to July, being only 5·5 inches, while the average rainfall for these months was 9·0 inches. The crop produced by the ammonia in the season of 1893 was also much below the average, being only 20·4 bushels as compared with an average of 30·3 bushels. It is clear, therefore, that a good deal of the manure applied in 1893 was not used by the crop, and in consequence of the drought the unused residue of nitrates must have been left at harvest near the surface of the soil. In the following autumn and winter (August to March) the rain is only slightly above an average, and following such a dry summer, the downward movement of the nitrates must have been less than usual. The following summer of 1894 is on the whole rather dry, the rain in April to July being 8·2 inches, but the general conditions are those of great fertility, the crop given by the plot receiving the ammonia salts being this year nearly 7 bushels above the average. We have then in 1893 conditions leading to some accumulation of nitrates in the soil and subsoil, while in the summer of 1894 we find conditions especially favourable for their utilisation by the wheat crop; the effect of the previous residue of manure is consequently shown in an unmistakable manner.

In the second instance the conditions are somewhat different. The crop of wheat in 1870 was above the average, and the residue of nitrates, if any, must have been at first much smaller than in 1893. Both the summer and the succeeding autumn and winter were, however, far drier than in 1893; the waste of the original nitrates, or of those subsequently formed in the soil, was thus much less. In 1871 we have a season of only moderate fertility, and the excess of 4·1 bushels of wheat finally placed to the credit of the residue of the ammonia salts is in this case due almost entirely to the very exceptional dryness of the preceding year.

In the third instance the conditions are again different. In 1889 the crop is very poor, but the larger quantity of nitrates left in consequence in the soil would be at some distance below the surface as the summer was decidedly wet; the total autumn and winter rainfall is, however, below the average, and much of the next spring and early summer was dry. The conditions of fertility in 1890 were indeed surprisingly good, the plot receiving the ammonia yielding a bumper crop of 41·5 bushels. In this instance the conditions were only moderately favourable to the accumulation of nitrates in the soil, and the final increase of 3·8 bushels, credited to nitrate residues, was largely due to the splendid character of the season in 1890; the extensive distribution of the roots of the wheat crop, and its vigorous power of assimilation, which always characterise a season of great productiveness, enabling the crop to collect and use to an unusual extent the nitrates remaining in the soil.

In the fourth instance the crop produced by the ammonia salts is so large that there was probably no residue of nitrates remaining in the surface soil at harvest; there was, however, an unusually large residue of roots, &c., left in the soil as crop-residue. The autumn and winter rains were much below the average, and the following spring dry. With scarcely more than average conditions of fertility in 1891, we find 3·1 bushels credited to the residue from the preceding year. The effect in this case is apparently mainly due to the nitrification of an unusually large crop-residue, and to the smallness of the waste in a dry winter and spring.

The last instance is one more difficult to interpret. We have, indeed, a very dry previous summer, doubtless leaving a notable residue of manure in the surface soil, but this is followed by an exceptionally heavy rainfall in the autumn; the rainfall in the early months of 1882 is, however, below the average, and this is followed by a rather wet growing period, fairly favourable to fertility. Under these mixed conditions we find an excess of 3·1 bushels recorded as due to the manuring of the preceding year.

We may now summarise the conditions leading to an effective

residue from nitrate of soda or sulphate of ammonia remaining over to a second season, as follows: 1. The use of a large dressing of the nitrogenous manure, or the occurrence of circumstances, as for instance drought, preventing the complete use of the manure by the crop. 2. A subsequently dry autumn and winter, preserving sufficiently near the surface of the soil any residue of nitrates left at harvest, and also the further amount produced after harvest by the nitrification of the organic matter of the crop-residue. 3. Conditions in the following spring and summer favourable to the collection of nitrates from the subsoil by the next season's crop: this will be accomplished if the spring is dry and mild, and an early and extensive root development takes place, followed by a season of very active growth. The Rothamsted results show that any one of these conditions, if fully developed, is capable of determining the result in question, if only the remaining conditions named occur to an average extent. We have also seen that an exceptionally heavy crop-residue remaining in the soil may act in precisely the same manner as a residue of unused manure.

At Woburn, as is well known, many of the Rothamsted field experiments have been repeated. In the field devoted to the continuous growth of wheat and barley, the effect of the residues from a last year's manuring, both with nitrate of soda and ammonia salts, has been for many years determined; the results obtained have, however, received little notice. The method employed has been the same as at Rothamsted. Superphosphate and salts of potash, soda, and magnesia are applied every year to a pair of plots, one plot of the pair receiving in addition a full dressing of nitrate of soda or ammonia salts. The next year this dressing is shifted to the other plot of the pair. There is thus every year a crop manured with a nitrogenous dressing, and another having only the residue from the last year's nitrogenous manuring. The effect of this residue is found by subtracting from the produce thus obtained the produce yielded in the same year by a plot continuously receiving the same quantity of superphosphate and alkali salts, but without any alternating dressing of nitrogenous manure.

The effects produced by the residues of nitrate of soda and ammonia salts are far larger at Woburn than at Rothamsted; the conditions are indeed different at the two stations. In the experiment at Rothamsted just considered, one-quarter of the ammonia salts was applied to the land towards the end of October, when the wheat was sown, and the remaining three-quarters was applied as a top-dressing at the end of March. At Woburn the same quantities of manure are used, but the whole is applied as a top-dressing in May, and sometimes as late as the middle of the month. With this largèr quantity of manure, top-dressed much later in the season, the chance of

some unused manure remaining in the surface soil at harvest is decidedly increased.

Again, in the Rothamsted wheat field there is a drain-pipe under the middle of each plot, at from 2 to 2½ feet below the surface; the discharge from these pipes passes freely into an open channel, and is lost to the plot. This plan, though affording a valuable opportunity for studying the composition of the water percolating downwards at various times of the year, may seriously diminish the quantity of nitrates passing into the subsoil, a part of which nitrates may be recoverable by the next crop.

The soils at the two stations are also quite different—that at Rothamsted being a heavy loam containing many flints, lying on chalk at a considerable distance below the surface; while that at Woburn is a very fine uniform sand, so fine that it can retain much water, and rarely suffers from drought. In such a soil we should expect that the roots of wheat and barley would distribute themselves to a greater extent than in the heavy stony land at Rothamsted, while the movements of the subsoil water containing nitrates would be much freer in the sandy soil.

From the Woburn experiments we will take as examples the results obtained from the residues of 528 lb. of nitrate of soda applied to barley. In the course of fifteen years there are four seasons in which the effect of the residue upon the succeeding crop of barley is especially marked; the particulars needed for the discussion of these results are given in the following table:—

SELECTED RESULTS SHOWING THE SUBSEQUENT EFFECT OF A LAST YEAR'S DRESSING OF NITRATE OF SODA TO BARLEY AT WOBURN (PLOTS 9A AND 9B).

| | Excess of second crop after Nitrate | Character of season | | Crop and rain of preceding season | | |
|---|---|---|---|---|---|---|
| | | Crop with Nitrate | Rain April to July. | Crop with Nitrate | Rainfall. April to July. | Rainfall. August to March |
| | bushels | bushels | inches | bushels | inches. | inches |
| Average* | 8·5 | 50·2 | 7·5 | 50·2 | 7·5 | 15·3 |
| 1894 | 16·1 | 51·8 | 9·0 | 26·9 | 6·9 | 13·3 |
| 1882 | 13·9 | 66·8 | 9·7 | 56·8 | . | ... |
| 1885 | 13·8 | 64·5 | 7·3 | 55·4 | 6·4 | 11·7 |
| 1890 | 10·0 | 54·0 | 6·4 | 39·1 | 10·8 | 12·9 |

* The average crop is calculated on a period of 15 years, the rainfall represents 20 years.

The average effect of the last year's residue from the dressing of nitrate of soda is seen to be 8½ bushels of barley; this is certainly a very considerable amount. An additional reason for the large effect of such residues observed at Woburn is supplied by the information as to the rainfall given in the

table. While the average annual rainfall at Rothamsted is 28·6 inches, that at Woburn is only 22·8 inches. The downward percolation of the soluble nitrates, due to the rain falling on the soil, is thus considerably less at Woburn than at Rothamsted, and the residues at Woburn remain to a much greater extent within the reach of the roots of the succeeding crop.

The year 1894 is, as at Rothamsted, the one showing the greatest effect from a previous residue, and the reasons are in both instances the same. We see again in this table the insignificance of the crop of 1893, leaving in consequence much of the nitrate applied in this year unused. The summer, autumn, and winter rainfall are also considerably below the average. The following season of 1894 is one of fully average fertility. As the final result, we find 16·1 bushels of barley to the credit of the last year's application of nitrate of soda.

The next year mentioned, 1882, is also one of the years showing a large return from residues at Rothamsted. We cannot in this case fully discuss the causes at work, as the rainfall for 1881 is not included in the Woburn records. The summer of 1881 was, we know, dry, but the chief factor contributing to the present result appears to be the splendid conditions of fertility occurring in 1882; a dry spring, followed by an ample supply of rain in summer, yielded a bumper crop of barley, and it is probably to the exceptional powers of collection and assimilation possessed by this crop that the large effect produced by the previously accumulated nitrates in the soil is due.

The third instance presents us once more with the familiar conditions of a dry preceding summer and winter, followed by exceptionally good conditions of fertility in the next spring and summer.

In the fourth instance there is at starting a decidedly small crop of barley, leaving a good deal of unused nitrates behind it, but probably not in the surface soil, as the summer was wet. Next follow a dry winter, spring, and summer—the latter, however, having good conditions of fertility. The excess of crop due to residue is not in this case very largely above the average.

We have mentioned that at Woburn experiments on the effect of residues are made both with wheat and barley, and with each crop both with nitrate of soda and ammonia salts. The quantities of manure applied are the same with both crops. Wheat is, however, found to be much less affected by previous residues than barley. Thus the average benefit from a last year's dressing of nitrate of soda does not in the case of wheat exceed half a bushel, while the same dressing of nitrate of soda to barley, we have already seen, leaves a residue having the average value of 8½ bushels. This fact is easily explained. A barley crop does not, under similar circumstances, need nearly so much nitrogenous manure as a wheat crop, and the dressing of 528 lb. of

nitrate of soda per acre was excessive for the barley though not for the wheat: there was thus in the case of the barley a larger residue of unused manure remaining in the soil at harvest. The reason why barley is more independent of nitrogenous manure than wheat is probably to be found in the spring tillage which barley land always receives; nitrification is thus actively started in the soil shortly before the barley is sown, and the crop being thus supplied with the newly formed nitrates of the soil, it stands in less need of an artificial dressing than is the case with the wheat crop; and if a large dressing is applied, a part will probably remain unused. Wheat land being ploughed in autumn, and then subjected to winter rain, suffers more loss of nitrates than barley land, and is found to be more or less exhausted in the spring.

The ammonia salts applied at Woburn to wheat and barley leave in each case a larger residue for the succeeding crop than the same quantity of nitrogen applied as nitrate of soda. The very small proportion of lime in the Woburn soil must tend to delay the nitrification of the ammonia. The nitrate formed from the ammonia salts is thus a later application to the land than the nitrate of the nitrate of soda, and this will be especially the case in a dry summer. As the manures in question are often not applied till the middle of May, this delay in nitrification must often hinder the assimilation of the manure by the crop, and increase the amount of unused residue.

### 2. *Potatoes.*

After growing potatoes continuously at Rothamsted for twenty-six years with various manures, two crops of barley were taken without manure. It was at once evident that very effective residues of manure remained on some of the potato plots. The results given by the barley crops were as follows :—

PRODUCE OF BARLEY WITHOUT MANURE AT ROTHAMSTED, ON LAND MANURED FOR TWENTY-SIX YEARS FOR POTATOES.

| Manuring for Potatoes | Potatoes, average crop | Barley unmanured. | |
|---|---|---|---|
| | | 1902 | 1903 |
| | tons | bushels. | bushels. |
| No manure . . . . . . . | 1·4 | 33·2 | 9·6 |
| Superphosphate . . . . | 2·7 | 35·1 | 13·3 |
| Ash constituents . . . . . | 2·9 | 24·8 | 12·8 |
| Ash constituents and ammonia salts, 400 lb. | 5·3 | 64·4 | 28·9 |
| Ash constituents and nitrate of soda, 550 lb. | 5·4 | 67·0 | 26·2 |
| Ammonia salts, 400 lb. . . . . . | 1·7 | 59·1 | 19·2 |
| Nitrate of soda, 550 lb. . . . . | 2·1 | 62·9 | 18 6 |
| Farmyard manure . . . . . . | 5·0 | 71·7 | 45 9 |

We see that the first crop of barley amounted to 25-35 bushels on the plots where no nitrogenous manure had been applied to the potatoes, but that on the four plots where ammonia salts or nitrate of soda had been continuously applied for many years, the barley reached an average of 63 bushels! This splendid crop of barley is not apparently due to the residue of vegetable matter left in the soil by the preceding crops of potatoes, for where the ammonia salts and nitrate of soda had been applied alone the potato crop barely reached an average of 2 tons per acre, and was indeed actually smaller than where superphosphate, with or without alkali salts, had been the only manure employed; yet even here, where the ammonia and nitrate were almost without effect on the potatoes, the land is able in the following season to produce 59·1 and 62·9 bushels of barley.[1] That this large effect on the barley was due to a residue of nitrates remaining in the soil from the previous year, is confirmed by the results shown by the second barley crop. In 1903 the effect produced by the residues of the ammonia salts and nitrate has greatly fallen off, while the increase given by the residue of the previous applications of farmyard manure is nearly the same in both years—namely, 38·5 and 36·3 bushels.

Of all the crops grown by a farmer in an arable rotation the potato is probably the most shallow rooted—its extension is indeed sideways rather than downwards; it is also often the crop most heavily manured. The loss of the large quantity of nitrates formed in the soil from the residues of this manure may clearly be to some extent prevented by following the potatoes with one or more cereal crops.

## Evidence given by the Drainage Waters.

We pass now from the testimony of the crops to other evidence as to the amount, distribution, and ultimate destiny of the nitrates in the soil and subsoil.

The drain-pipes under the plots devoted to the continuous growth of wheat at Rothamsted become of great value when we desire to know what is the composition of the water which the upper soil contains. As the nitrates in a soil are all in a state of solution, the analysis of the drainage waters shows us the relative richness of the various experimental plots in nitrates, so far as the soil above the drain-pipes is concerned. The evidence supplied by the drainage waters is in one respect of peculiar value, as it tells us what is the state of matters while

[1] The vegetable residue left on the plots receiving only ammonia salts or nitrate of soda was, however, greater than would appear from the weight of potatoes, as the haulm on these plots was particularly luxuriant.

the crop is still growing on the land; it has, however, its weak point—its evidence is confined to those occasions when the rain has been sufficiently heavy to make the pipes run. The drain-pipes, as already mentioned, are under the middle of each plot, and between 2 and 2½ feet beneath the surface of the soil.

The drainage waters from all the plots contain a notable amount of nitrates whenever they run in winter time. When, however, the wheat begins to grow in April, the nitrates rapidly diminish in the water from all the plots which do not receive nitrogenous manure, and in May the nitrates in these waters have generally disappeared, and this absence of nitrates continues till after harvest. The first autumn running contains very little nitrate, but the amount rapidly increases at each running of the pipes, the maximum being usually reached towards the end of October. If there is a wet winter, the proportion of nitrate in the water slowly diminishes as winter proceeds.

When a spring dressing of ammonia salts or nitrate of soda is applied to the land in March, and heavy rain follows, the drainage water is for a short time exceedingly rich in nitrates, and a serious loss may occur. The composition of the subsequent runnings of the pipes depends very much on the amount and character of the manure applied. If the soil has been well supplied with phosphates, potash, and the other necessary ash constituents of the crop, and the dressing of ammonia salts has been only 200 lb. per acre, the nitrates will probably disappear from the water in May, and will not reappear till after harvest. If the dressing of ammonia salts is 400 lb. per acre, or 550 lb. of nitrate of soda are applied, the nitrates will probably disappear during June, or at least diminish to a very small quantity; but if the dressing of ammonia salts is raised to 600 lb., the nitrates will be found, though in diminished quantity, throughout the whole summer.

The disappearance of the nitrates in summer time depends entirely on the power of the wheat crop to assimilate the nitrates in the soil, and this assimilation of nitrates will only occur when the crop is furnished with the other essential plant-foods—as phosphates and potash salts. When, therefore, 400 lb. of ammonia salts or 550 lb. of nitrate of soda are applied alone for a series of years without phosphates or potash, the nitrates in the soil are greatly in excess of the power of the crop to make use of them, and they continue to be present in the drainage waters in large quantity all through the summer.

The figures in the following table will illustrate what has just been stated:—

NITROGEN AS NITRATES IN THE DRAINAGE WATERS OF VARIOUSLY MANURED WHEAT PLOTS AT ROTHAMSTED, AVERAGE OF FIVE YEARS, 1878-83, IN PARTS PER MILLION.[1]

| Manuring per acre | March to end of May | June to harvest | Harvest to end of October | October to March |
|---|---|---|---|---|
| No manure . . . . . | 1·7 | 0·1 | 5·6 | 3·9 |
| Ash constituents . . . | 1·7 | 0·2 | 5·6 | 4·5 |
| Ash constituents and ammonia salts, 200 lb. . . . . . . | 8·1 | 0·7 | 7·3 | 4·8 |
| Ash constituents and ammonia salts, 400 lb. . . . | 16·3 | 1·4 | 8·3 | 5·2 |
| Ash constituents and ammonia salts, 600 lb. . . . . | 21·5 | 4·0 | 14·7 | 7·3 |
| Ammonia salts, 400 lb. . . | 28·6 | 11·4 | 11·5 | 6·3 |
| Superphosphate and ammonia salts, 400 lb. . . . | 19·5 | 5·8 | 9·2 | 7·1 |

The five years to which the figures in the table refer are a part of the period in which the whole of the ammonia salts was applied in the spring. Unfortunately there was at this time no drainage water from a plot receiving nitrate of soda, either alone or with ash constituents, with which we can make an accurate comparison.

The serious losses of nitrates which may occur in spring, shortly after the application of the ammonia salts, are plainly shown by these figures. In summer time there is very little nitrate to be found in the water discharged from the upper soil, unless the quantity of ammonia salts applied is very large (600 lb.), or, still more, where no phosphates or potash have been applied for a great many years, but ammonia salts only. The results from the plot placed at the bottom of the table show that the addition of phosphates only to the ammonia salt is but a partial remedy for the waste of nitrates. After harvest, and especially after ploughing, a new and very considerable supply of nitrates arises in the soil from the nitrification of the vegetable residues left by the preceding crops; the quantity of nitrate is greater in proportion to the weight of the previous crops. We may assume that all the nitrate found in the autumn and winter drainage from the first two plots mentioned in the table is derived from recent or previous crop- and weed-residues, with the exception of some, probably small, supply of nitrogen from the atmosphere. Of the next two plots the same may be said with little qualification, the residue of unused nitrates left from the manure being generally inconsiderable. In the

[1] This table is reprinted from my American lectures.

case of the last three plots, the existence of a residue of nitrates from the manure becomes plainly manifest, and its presence is perceived through the greater part of the winter.

## Evidence afforded by the Soils and Subsoils.

### 1. *Extraction of Nitrates by various Crops.*

We have just seen that in the Rothamsted wheat field the upper soil may become practically denuded of nitrates during a favourable summer, when assimilation by the crop is actively in progress. The depth of soil which may be thus denuded of nitrates by a crop will depend naturally upon the distance to which the roots extend, and will be different in different seasons and in different soils; it will also be markedly different with different crops. Some scanty but interesting information on the subject is supplied by some of the analyses of subsoils made at Rothamsted.

In Broadbalk Field, where wheat is continuously grown, the drain-pipes, as already mentioned, are on an average 27 inches beneath the surface of the land, and this 27 inches, we have seen, from the evidence of the drainage water, may, in the case of some of the plots, be left practically without nitrates at harvest. The soil of this field has been several times sampled and analysed, but never immediately after harvest; it has been sampled in October after the field has been ploughed. Nitrification having by this time energetically commenced at the surface, and the nitrates having been carried down to a moderate distance by rain, instead of an absence of nitrate being shown in the surface soil and upper subsoil, it is in these that the largest quantity is found, even in the case of the permanently unmanured land. In October 1893 samples of the soil and subsoil were taken from all the plots, and in the case of some of them the sampling was carried out down to a depth of 6 feet, and in others to 7 feet 6 inches (see p. 163). The analyses of these subsoils do not show that the preceding wheat crop had extracted the nitrate from any portion of the subsoil. The wheat crop of this year was, however, a miserable one, owing to the extreme drought, and the extension of its roots and its assimilating power must have been very limited.

The soils of the experimental rotation field at Rothamsted were sampled in the autumn of 1883, after a wheat crop considerably above an average in quantity. On one plot, which had yielded 38½ bushels of wheat per acre without manure, the nitrates in the subsoil had apparently been largely drawn upon down to a distance of 54 inches beneath the surface, and prob-

ably to a less extent in the succeeding 18 inches. Disregarding the 18 inches at the surface of the field where nitrification had recommenced after harvest, we find below this limit 3 feet of subsoil, in which the quantity of nitrogen as nitrate never reaches 1 lb. per acre[1] in 9 inches of soil, and is frequently only half this amount. After passing 54 inches the nitrate doubles in quantity, and after 72 inches is again doubled, and remains at this highest point down to 108 inches, the deepest sample taken.

On another plot of the same field, where the wheat crop was still larger—namely, 45¼ bushels—a similar exhaustion of the nitrates in the subsoil is found down to 81 inches below the surface; beyond this point the nitrates are three or four times greater in amount. A wheat crop is thus apparently capable, when fully developed, of drawing on the accumulated nitrates in the subsoil to a very considerable extent. Both the wheat crops in question followed a bare summer fallow, but received no manure.

The remaining results at Rothamsted bearing on the present question relate to leguminous crops. The fact that these crops derive very much of their nitrogen from the atmosphere is apt to make us forget that they also feed on the nitrates of the soil; such crops may, in fact, prove very effective in utilising subsoil nitrates. In Hoos Field various leguminous crops are grown continuously year after year; some of the soils and subsoils bearing these leguminous crops were sampled in July 1882, and again in 1883 and 1885, the soil sampling following the cutting of the hay. A good crop of white clover in 1885 had apparently taken nitrates from the soil to a depth of 36 inches. Spring vetches in 1883 had done the same to a depth of 36 to 45 inches. A good crop of Bokhara clover (*Melilotus leucantha*) in 1882 had been effective down to 45 to 54 inches. Lucerne (1885) surpassed all the other crops, for the whole of the subsoil was found to be practically exhausted of nitrates down to 108 inches below the surface, the lowest point which the sampling reached. In 8 feet of lucerne subsoil there was only 8 lb. of nitrogen in the form of nitrates per acre. The lucerne had been established for seven years on this plot.

The practical bearing of these few facts will be obvious to all. The more vigorous a crop is, and the farther its roots extend, the larger use it will make of the nitrates which have escaped into the subsoil. The large crops which are produced on even poor soils in a really fine season are greatly due to the exceptional range of the roots in such a season, new supplies of food being thus reached which in an ordinary season would remain untouched. Some crops also greatly exceed others in the depth

[1] 1 lb. of nitrogen corresponds with 6·4 lb. of nitrate of soda.

to which their roots descend. Ordinary red clover is probably the deepest rooted crop of those ordinarily grown by farmers, though an old-established plant of lucerne would have a still greater root development. Red clover is undoubtedly the most conservative crop in an ordinary rotation, as it turns to use subsoil nitrates which no other crop can reach, besides obtaining much nitrogen from the air. In the four-course rotation field at Rothamsted, six rotations including clover alternate with six rotations in which a bare summer fallow takes the place of clover. The soils and subsoils of this field were sampled in 1883 after the wheat crop. Only some of the samples have been examined for nitrates, but those examined include all the subsoils at the lowest depth reached. At this depth of nearly 9 feet, the subsoils of the clover rotations are in every case distinctly poorer in nitrates than the corresponding subsoils where a bare fallow has taken the place of clover. The quantities of nitrogen as nitrates per acre found in 9 inches of subsoil, at a depth of 9 feet below the surface, were as follows:—

| Nitrogen as nitrates in wheat subsoils | |
| --- | --- |
| After fallow. | After clover |
| lb | lb |
| 2·60 | 0 81 |
| 3 50 | 1·82 |
| 4 45 | 2 77 |
| 3 11 | 0 90 |
| 3·75 | 2 83 |
| 3·67 | 2 04 |

The mean is 3·51 lb. of nitrogen as nitrates after fallow, and 1·86 lb. after clover. The loss of nitrates in the deepest subsoil was thus greater when a bare fallow preceded the wheat than when red clover had been grown.

### 2. *Quantity of Nitrates in Wheat Soils and Subsoils.*

The quantities of nitrates in the soils and subsoils of Broadbalk wheat field were determined both in October 1881 and in October 1893; the latter determinations include in some cases an examination of the subsoil down to 90 inches below the surface: the results for 1893 have only recently been published in Dr Dyer's lectures. The quantities of nitrogen as nitrates in pounds per acre found in each succeeding 9 inches of soil are shown in the following table:—

NITROGEN AS NITRATES IN THE SOIL AND SUBSOIL OF LAND AT ROTHAMSTED VARIOUSLY MANURED AND GROWING WHEAT CONTINUOUSLY, IN LBS. PER ACRE.

| Depth of soil. | Plot 3 & 4 | Plot 5 | Plot 6. | Plot 7. | Plot 8. | Plot 9a * | Plot 9b.* | Plot 16. | Plot 10. | Plot 11 | Plot 13. | Plot 17. | Plot 18. | Plot 2b. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No manure. | Ash constituents | Ash constit., am salts, 200 lb | Ash constit., am salts, 400 lb | Ash constit., am salts, 600 lb | Ash constit., nit soda, 225 lb | Nit soda, 225 lb | Ash constit., nit soda, 550 lb. | Am salts, 400 lb | Superphos., am salts, 400 lb. | Superphos., pot. salts, am. salts, 400 lb. | Ash constituents, and am salts, 400 lb. alternating. Ash. | Amm. | Farmyard manure, 14 tons. |
| *Samples taken October 1881.* | | | | | | | | | | | | | | |
| | lb | lb | lb | lb | lb | lb | lb | lb. | lb. | lb. | lb. | lb. | lb | lb |
| 1st nine inches . . | 9·6 | 12·8 | 16·8 | 20·6 | 21·4 | 20·0 | 16·5 | . | 14·0 | 18·2 | 12 8 | 10·9 | 11·6 | 29·3 |
| 2nd " " . . | 4·6 | 7·0 | 7·4 | 11·1 | 13·8 | 9·9 | 19·9 | . . | 10·3 | 9·1 | 8 8 | 7·4 | 8·3 | 15·2 |
| 3rd " " . . | 2·3 | 4 7 | 4·8 | 5 8 | 7 9 | 8·3 | 18·0 | | 6·7 | 3·7 | 2 6 | 3 5 | 5·3 | 6·8 |
| Total 27 inches . . | 16 5 | 24·5 | 29·0 | 37·5 | 43 1 | 38·2 | 54 4 | . . | 31·0 | 31·0 | 24 2 | 21·8 | 25·2 | 51·3 |
| *Samples taken October 1893.* | | | | | | | | | | | | | | |
| 1st nine inches . . | 8·8 | 10 5 | 14·1 | 15·0 | 17 4 | 16 6 | 11 1 | 13 6 | 11 0 | 11·7 | 13·9 | 12 2 | 11·6 | 10·5 |
| 2nd " " . . | 8·1 | 6 4 | 12·7 | 19 2 | 29·2 | 19 2 | 34·9 | 42·6 | 27·2 | 24·6 | 26·2 | 27·7 | 41 5 | 45·4 |
| 3rd " " . . | 2 4 | 2·2 | 5 8 | 8·5 | 8·7 | 6·7 | 15·6 | 20 8 | 12·6 | 14 9 | 9 4 | 8·5 | 6·4 | 12·3 |
| 4th " " . . | . | 1·0 | 3 0 | 5·3 | 8·7 | | . | 13 0 | . | 11 7 | 4·7 | 2·9 | 3 4 | . |
| 5th " " . . | . | 1·0 | 3 5 | 4·6 | 8 5 | . | | 7 8 | . | 8·6 | 3 5 | 1 8 | 2 9 | |
| 6th " " . . | | 0·7 | 3 7 | 4 4 | 7·5 | | . | 6 0 | | 5·0 | 3 8 | 1·7 | 1·7 | . . |
| 7th " " . . | | 1·0 | 3·3 | 4·5 | 8·0 | | | 5 5 | ... | 4·5 | 3·5 | 1·4 | 1·4 | .. |
| 8th " " . . | | 0 9 | 1 9 | 4·0 | 7 6 | | . | 6·3 | . | 6·1 | 3·7 | 1·7 | 1·4 | . |
| 9th " " . | | 0 9 | 2·5 | 4·3 | 6 1 | | | | . | | . | | . | . |
| 10th " " . . | | 0·6 | 2 2 | 4·4 | 5·6 | | | | . | | | . | . | .. |
| To 27 inches . . . | 19·3 | 19 1 | 32·6 | 42·7 | 55 3 | 42 5 | 61·6 | 77·0 | 50·8 | 51·2 | 59·5 | 48·4 | 59·5 | 68·2 |
| Below 27 inches † . | | 6·0 | 20·0 | 31 6 | 52·0 | | | 50·4 | . | 46·3 | 26·4 | 12·7 | 13·8 | |

* Plots 9a and 9b were receiving 550 lb of nitrate of soda in 1881

† In calculating these figures the nitrogen as nitrate in the 9th and 10th depth of plots 16, 11, 13, 17, and 18, has been taken at the mean rate of the 6th, 7th, and 8th depth of those plots.

As the soil sampling in every case took place in the latter half of October, after the land had been ploughed and much rain had fallen, we find no indication of the exhaustion of the nitrates by the growing crop. In many cases in 1881, and in a few cases in 1893, the surface soil was doubtless practically exhausted of nitrates at the beginning of harvest, but by the time the soil samples were taken, the moistening of the soil by rain, and the subsequent ploughing, had started a vigorous nitrification in the upper soil, which is therefore found to be in every case rich in nitrates.

In the case of the samples taken in 1881, the first 9 inches is in nearly every case the richest in nitrates. The surface soil is always the seat of the most active nitrification; it contains by far the largest amount of nitrifiable matter, it becomes soonest moist after harvest, and in the subsequent cultivation is far more thoroughly pulverised and aerated than any other portion of the soil. In the case of the samples taken in 1893 the second 9 inches is nearly alway the richest in nitrates. We here see the nitrates in the act of descending into the subsoil under the influence of rain. The quantity of nitrates in the upper 27 inches is, in almost every case, greater in 1893 than in 1881. In 1881 the wheat crop was rather below the average, but in 1893 it was much worse, and very considerable residues of nitrates from the manures applied must have remained unappropriated upon many of the plots. Plots 8, 9*b*, 16, 10, 11, 13, 18, and 2, are clearly instances of the presence of such a residue. In 1881 there is apparently a considerable residue of unused nitrate of soda on plot 9*b*, which was at that time receiving 550 lb. of nitrate of soda without any manure supplying ash constituents.

When we come to the third depth we find a considerable amount of nitrate in the case of two plots, 9*b* and 16, which had received more nitrate of soda than the crop could make use of, but in the case of most of the plots the falling off in the amount of nitrate at this depth is very considerable.

The subsoil below 27 inches generally exhibits a very even composition throughout its whole extent; the subsoil of every plot has its own character, and that character is usually preserved unaltered from the fourth to the tenth 9 inches. This uniform composition of the deeper subsoil is due to the uniform conditions of manuring and cropping maintained in the experimental field, to the alternation of strong and weak drainage waters from above, and the final equalisation of their contents by the molecular diffusion of the salts which they held in solution.

The quantity of nitrate in this deeper subsoil is plainly determined by the surface manuring. Where no nitrogen has been

applied in the manure for many years (plot 5), only 6 lb. of nitrogen as nitrates are found in 5 feet of subsoil; where the ammonia salts applied are 200 lb. per acre, the nitrogen occurring as nitrate in the subsoil becomes 20 lb.; where the ammoniacal manure is twice as great, it rises to 31·6 lb.; where it is three times as great, the nitrogen as nitrate becomes 52 lb. Any excess of ammonia or of nitrate in the manure applied is shown in the composition of the subsoil—see, for instance, plot 16, with (apparently) 50·4 lb. of nitrogen as nitrate below 27 inches: and compare the results given by plots 11 and 13, the addition of a potash salt on the latter plot diminishing the waste of nitrate in the subsoil in a remarkable manner. Where the ammonia salt is only applied every alternate year (plots 17 and 18), the quantity of nitrogen as nitrates is only 12 to 13 lb. in 5 feet of subsoil.

We have already mentioned that each plot in the experimental wheat field at Rothamsted is provided with a drain-pipe, the discharge from which is conveyed away, and that these pipes lie about 27 inches below the surface. It will naturally be asked, What influence have these drain-pipes on the quantity of nitrates found in the underlying subsoil? I believe that they have had very little influence on the facts now before us. Considerable quantities of water and of nitrates undoubtedly pass out of the soil by these pipes, and had the experiment only just commenced, we should find considerably less nitrate in 5 feet of subsoil below a pipe than where no pipe existed. But we must recollect that the water which passes down into the subsoil contains nearly the same percentage of nitrates in solution as the water which is discharged from the pipe (see p. 172), and the contents of the subsoil in nitrates depends wholly on the strength of the water which moistens it. If we could sample the subsoils of the Rothamsted plots to a far greater depth than has yet been done, we should doubtless discover that the nitrates arising from the surface manuring had not penetrated so far below a drain-pipe as where no drain-pipe existed, but above that point the amounts of nitrate in each 9 inches of soil would be found quite similar. The experiments at Rothamsted have now proceeded uniformly for so many years that the subsoils below the range of the roots are saturated with the average drainage water of the soil to a very considerable depth.

### 3. *Quantity passing beyond the reach of Crops.*

The whole of the nitrates in the subsoil are in a state of gradual movement downward, determined by the fall of rain upon the surface of the land. In a normal season this movement is pretty continuous during the autumn and winter months; it

ceases in a persistent drought, and generally during the time of the active growth of the crop. The cause of this movement is very simple. Each 9 inches of the Rothamsted subsoil retains a certain volume of drainage water containing nitrates in solution; when an equal volume of water descends from the surface, the solution previously held is displaced and pushed into the 9 inches of soil beneath it, expelling at the same time the solution which this soil had previously held. The solutions in the subsoil are thus in constant movement downwards so long as percolation is taking place at the surface.

It is plain that if we knew the quantity of water in 9 inches of the Rothamsted subsoil, we should also know the quantity of fresh drainage from above which would cause a descent of 9 inches in the subsoil nitrates. In Dr Dyer's lectures, the average amounts of water found in the subsoils of the Rothamsted wheat field at the time of sampling are given. From the third to the eighth depth (18 to 72 inches below the surface) the amounts of water found are very uniform, and average 780,000 lb. per acre in each 9 inches of subsoil. Below 72 inches the quantity of water rather diminishes, as chalk begins to appear. Now 780,000 lb. of water per acre are equivalent to 3·4 inches. If, therefore, 3·4 inches of fresh drainage water descend from the surface, the subsoil nitrates will move 9 inches downwards.

What is the amount of water passing downwards in this wheat field in a normal season? Let us first consider this question in its simplest aspect, disregarding for the moment the existence of the drain-pipes.

The average rainfall at Rothamsted is about 28·5 inches. The amount of rain water which passes downwards through the soil depends not only on the rainfall, but on the extent of the evaporation which takes place both from the surface of the land and through the crop growing upon it. The drain-gauges at Rothamsted supply information as to the amount of rain water which percolates through an uncultivated and uncropped soil similar to that occurring in the wheat field. The surface of the soil in the drain-gauges is kept free from weeds, and the whole of the water passing through is collected and measured. The drain-gauges were established in 1870. The amount of water which evaporates from their surface has decreased somewhat during their use, and the proportion of water passing through has consequently increased; this is probably due to the long continued effect of rain on the surface of the soils, washing away the finer particles, and leaving the surface abnormally covered with small stones; a slight growth of moss has also appeared. Instead, therefore, of taking the average amount of drainage during the whole thirty-three years, I prefer for our present purpose to take the results furnished by

the first ten years, when the conditions of the soil were more similar to those of ordinary arable land. The average quantity of water percolating annually through 5 feet of soil, under a normal rainfall, would, under the conditions of the first ten years, be 10·3 inches.[1] If Broadbalk wheat field was without a wheat crop we should expect that the water passing through the soil would be somewhat less than this, as the ploughing of the land in autumn would certainly increase the rate of evaporation at the surface.

The quantity of water passing through the soil of the wheat field will, however, be considerably diminished owing to the large evaporation of water by the growing crop. Many investigations have been made to ascertain how much water is taken up by a crop and evaporated by it for one part of dry matter formed. The quantity of water thus consumed in the process of plant nutrition is found to be very large; it also varies a good deal with the conditions of the soil and climate. A plant grown in an arid region, in a soil charged with salts, will evaporate much less water per unit of dry matter produced than the same plant grown in a soil liberally supplied with water. Any estimates we might take of the average amount of water consumed by the various experimental wheat crops would, however, be of little use, as while the crop is actively taking water from the soil, it is at the same time diminishing to an unknown extent the evaporation from the land surface, which it protects from sun and wind. We know a good deal as to the average annual evaporation from a bare Rothamsted soil, and something definitely as to the quantity of water required by a wheat crop, but we do not know at present what is the total amount of evaporation which takes place when the wheat crop is growing upon the soil.

We may arrive, however, at a pretty correct idea of the amount of water passing down into the subsoil if we take a general view of the condition of the field while the wheat crop is growing. In a season of average rainfall it is very rare for any running to take place from the drain-pipes of Broadbalk field from the beginning of April to the end of September. In the course of thirty-six years the drain-pipes on the plots carrying fair crops have not run on an average more than twice annually during these six months, and these runnings have nearly all occurred in the wetter seasons of this period. Roughly speaking, the upper soil of the wheat field in a normal season may be considered to be in a similar condition of moisture on April 1 and September 30, and not to have lost more water by drainage between April and September than

[1] The average for the whole thirty-three years, with a normal rainfall, is 13·2 inches.

has been taken up by the roots of the crop in the same time from below the level of the drain-pipes. The effective drainage in Broadbalk field takes place between October 1 and March 30. As during this period there is no actively growing crop on the land, we can estimate the amount of drainage from the results shown during the same months by the drain-gauges. During the first ten years, the drainage through 20 inches of soil in the drain-gauge during the six months October to March was, when calculated for a normal rainfall, 8·2 inches: this figure, I think, gives us a fairly correct idea of the amount of water which would in a normal season pass annually into the subsoil of Broadbalk wheat field if no drain-pipes existed. In a season of very exceptional rain this amount of drainage might be nearly doubled. In a season of very exceptional drought it might be halved.

The amount of water passing downwards cannot, however, be equal on all the plots. The quantity of dry matter in the crop of plot 7 is nearly three times as great as that in the crop on plot 3, and plots 16 and 8 give an even larger produce than plot 7. The downward drainage on such plots as 3 and 5 must distinctly exceed 8 inches; but farther than this we cannot certainly go.

We have already seen that 9 inches of Broadbalk subsoil contain 3·4 inches of water; it follows that an annual downward percolation of 8·2 inches of water would carry the nitrates of the subsoil 21·7 inches lower. The movement will really be less than this, as a portion of the percolating water escapes by the drain-pipes. We have already pointed out that we may reasonably assume that the discharge from a drain-pipe has nearly the same average composition as the water passing down around it. If we might assume that the water passing below the upper 27 inches suffered no chemical change on its way to the deeper subsoil, then the existence of the drain-pipes would be no hindrance to a calculation being made as to the whole annual loss of nitrates by drainage in the field. The total volume of drainage passing away as final loss, either through subsoil or pipes, is about 8·2 inches, subject to the variations already referred to; the strength of this lost water in nitrates would, on the assumption already made, be shown by the mean composition of the deeper subsoils in the table on p. 163. We should then have simply to calculate the quantity of nitrates present in this volume of water of known composition. Unfortunately we shall see presently that the assumption just made is inadmissible. Although, however, we are unable to calculate from these figures the whole loss of nitrates taking place in the field, they do enable us to form a definite idea of the quantity of nitrates which may annually pass out of the

deeper subsoil into the chalk, which is one of the several items of loss which we seek to determine. We proceed, therefore, with our calculation.

In the case of plot 7, the soil between the depth of 36 inches and 70 inches contains very uniformly 4·37 lb. of nitrogen as nitrates in each 9 inches of subsoil; now 21·7 inches of such subsoil would contain 10·5 lb. of nitrogen as nitrates; this, then, should represent the average annual amount passing out of the deeper subsoil into the chalk, if no drain-pipes existed. Calculating in a similar way the average annual loss of nitrogen as nitrates in the case of other plots, the results are as follows:—

*Annual Loss of Nitrogen as Nitrates per acre by Percolation into the Chalk in the Wheat Field at Rothamsted, assuming an annual drainage of* 8·2 *inches.*

| | Manures applied. | Nitrogen as nitrates. lb. |
|---|---|---|
| Plot 5. | Ash constituents only | 2·1 |
| " 6. | Ash constituents and ammonia salts, 200 lb. | 6·8 |
| " 7. | Ash constituents and ammonia salts, 400 lb. | 10·5 |
| " 8. | Ash constituents and ammonia salts, 600 lb. | 17·4 |
| " 16. | Ash constituents and nitrate of soda, 550 lb.[1] | 14·3 |

These figures probably give us a fair idea of the final losses by percolation which would take place in an arable field of heavy loam, cropped and manured like that of Rothamsted. The amounts are, of course, larger than those which actually occur in the Rothamsted field, as a part of the 8·2 inches of drainage escapes in this field by the drain-pipes. This pipe drainage, we shall see presently, is of a greater strength than the water in the deeper subsoil.

The composition of the deep well waters in a district supplies good evidence of the quantities of nitrates which are finally lost to the soil by percolation. In Harpenden the water of the uncontaminated wells in the chalk never contains less than 4·4 parts of nitrogen as nitrates per million of water, and the average lies between 4·7 and 5·2. If we assume the general drainage of the district to be 8 inches per annum (it is possibly less than this), the annual loss of nitrogen as nitrates per acre will be 8·5 to 9·4 lb.; these amounts are quite similar to those lost by the moderately manured land in the wheat field.

Returning to the wheat field, we have next to notice the important fact that the quantity of nitrates passing downwards from the upper soil is far greater than that passing through the lower subsoil into the chalk; this fact implies a considerable consumption or loss of the nitrates occurring in the upper soil or immediately below it.

[1] The nitrate of soda supplies very nearly the same amount of nitrogen as 400 lb. of ammonia salts.

## 4. *Destiny of the Nitrates formed in the Upper Soil.*

What becomes of the large quantity of nitrates shown in the upper soil in the table on p. 163? As it is much better to discuss the ordinary condition of affairs rather than the exceptional, if we desire to arrive at general conclusions, we will take as our examples the quantities of nitrate found in the upper 27 inches of the soil in 1881, as these will more nearly represent the quantities ordinarily present near the surface in October than the still larger quantities found after the very exceptional summer of 1893. There is no inconsistency in discussing together for general purposes the upper soil of 1881 and the subsoils of 1893. The quantities of nitrate in the deeper subsoils of 1893 have no connection whatever with the quantities found the same year in the upper 27 inches; the subsoil nitrates found in 1893 are the result of the previous drainage in 1892 and 1891, and not improbably also in 1890. The crop in 1892 was, in the case of the principal plots, but little below an average, and the drainage of the two winters preceding and following this crop was also not far removed from the average; the deeper subsoils in 1893 thus represent the condition of the wheat field under fairly normal circumstances.

Taking plot 7 as our first example, we see that the upper 27 inches contained 37·5 lb. of nitrogen as nitrates in October 1881; this quantity of nitrates was associated, according to Dr Dyer's table, with 9·6 inches of water. In the deeper subsoil of this plot we find uniformly 4·37 lb. of nitrogen as nitrates in 3·4 inches of water. A simple calculation shows that rain water producing 19·6 inches of drainage must be added to the upper soil to produce a solution of the strength found in the subsoil. In fact, a still larger addition of water would be needed, as nitrates would continue to be formed near the surface through the whole of the autumn and winter. No such bulk of drainage could take place even in the wettest season, and we must, therefore, conclude that the subsoil nitrates have not reached their actual strength by a mere dilution with rain water: there has occurred, besides, a very considerable consumption or loss of the nitrates formed near the surface.

If we now proceed to calculate in the same way, in the case of other plots, the quantities of percolating rain required to dilute the surface nitrates to subsoil strength, we find that the quantity of water demanded increases greatly when we pass to plots supplied with much less nitrogen than plot 7, and, on the other hand, considerably decreases when we come to plots receiving a more excessive, or more effective, supply of nitrogen.

Thus for plot 5, with no nitrogenous manure,[1] 65·9 inches of water would be needed; for plot 18, with ammonia salts every alternate year, 45·7 inches; for plot 6, with 200 lb. of ammonia salts every year, 25·0 inches. On the other hand, the same calculation made in the case of plot 9*a*, 1881 (plot 16, 1893), receiving 550 lb. of nitrate of soda, shows 12·3 inches of percolating rain required; while in the case of plot 8, receiving 600 lb. of ammonia salts, the requirement still further falls to 10·7 inches. As already mentioned, considerably more water would really be required in every case to effect the dilution we have in view, as nitrates would continue to be formed in the surface soil after the soil sampling in October.

There can be little doubt that the consumption of nitrates by the growing crop is a principal cause of the wide differences just mentioned. We have seen that the nitrates formed in late summer and autumn in the surface soil are not generally carried by rain below the fourth or fifth 9 inches, a distance within the range of the wheat roots in a normal season. On plot 5, receiving no nitrogenous manure, a large proportion of the nitrates in the upper subsoil is doubtless assimilated by the crop in the following spring, and their amount is thus reduced to the minimum quantities shown in the analyses of the deeper subsoil on p. 163. On plot 6, the supply of nitrogenous manure is insufficient for a full crop; here, too, the assimilation of subsoil nitrates by the wheat roots will take place, but, as the analyses show, without effecting their removal as completely as in the case of plot 5. When we turn, however, to plot 7, we have a supply of ammoniacal manure in the spring nearly sufficient for the largest crop an ordinary season can produce. This is still more truly the case on plots 9*a* (1881) and 16, receiving nitrate of soda; while on plot 8 (and also on plots 10 and 11) the supply of ammonia salts is in excess of the requirements of the crop in any ordinary season. On this latter series of plots the wheat draws its supply of nitrates chiefly, or entirely, from the ample quantity present in the upper soil, which receives in March the liberal manuring already mentioned; the crop makes consequently but little use of the subsoil nitrates, and their strength is not seriously diminished by root action. Although the assimilation of nitrates by the wheat crop accounts for much of the consumption of nitrates observed in the soil, it by no means accounts for all of it, and other sources of loss must be assumed to exist.

About twenty-two years ago Sir J. H. Gilbert attempted to

[1] Plot 5 is here taken as containing in the upper 27 inches 19·1 lb. of nitrogen as nitrates; this is the quantity found in 1893. The larger quantity found in 1881 seems abnormally high. If the nitrates are reckoned at the 1881 figure, the water needed to dilute them to subsoil strength will be 87·3 inches.

calculate the annual quantity of nitrates passing below the upper 27 inches of the soil from the composition of the water escaping by the drain-pipes;[1] these estimates have lately been reprinted by Dr Dyer in his American lectures. The estimates arrived at for some of the principal plots were as follows:—

*Sir J. H. Gilbert's estimates of the Annual Loss of Nitrogen as Nitrates in the Drainage Waters of the Rothamsted Wheat Field.*

| | Manures applied. | Nitrogen as nitrates. lb. |
|---|---|---|
| Plot 5. | Ash constituents only . . . . . . | 12 0 |
| " 6. | Ash constituents and ammonia salts, 200 lb. . . | 19 0 |
| " 7. | Ash constituents and ammonia salts, 400 lb. . . | 31 0 |
| " 8. | Ash constituents and ammonia salts, 600 lb. . . | 42 5 |
| " 9. | Ash constituents and nitrate of soda, 550 lb. . . | 35·7 |

It must be clearly understood that these amounts do not aim at showing the loss taking place through the drain-pipes, but in the whole drainage downwards through the soil. It is also clear that all the nitrates in the percolating water should not be reckoned as loss, as on some of the plots a considerable part will subsequently be assimilated by the roots of the wheat crop. What these estimates really supply is some idea of the quantity of nitrates passing each year below the upper 27 inches of the soil.

When we refer to the method by which these figures were arrived at, there appear to be two errors, both tending towards excess. First, the amount of drainage in the wheat field is reckoned too high, the summer drainage under a wheat crop being taken as the same as the summer drainage of the bare uncropped soil of the drain-gauge. Second, the richness of the drainage water in nitrates is overrated, the composition of the drainage water adopted being the mean of all the analyses made in each period, without regard to the quantity of the discharge from the drain-pipes which each analysis represented; the stronger little runnings were thus placed on the same footing as the weaker large runnings, and the mean composition calculated for the water would be above the truth. It must be recollected, however, that there was no means of avoiding some error of this kind, as the quantity of water passing from the pipes was not known; its composition would also vary considerably during a single running. Sir J. H. Gilbert was quite aware of the uncertainties involved in these calculations; he says, "The estimates must be taken as only approximations to the truth."

Although the estimates made by Sir J. H. Gilbert should, for

[1] Jour. Roy. Agri. Soc., 1882, p. 54. This paper is in the names of Lawes, Gilbert, and Warington; the last section of the paper, dealing with the losses in the wheat field, was drawn up by Sir J. H. Gilbert.

the reasons just given, be more or less too high, there is, on the other hand, evidence that they may actually be too low if we regard them as representing only the quantity of nitrates passing through the upper 27 inches of the soil. Several considerations lead to this conclusion. Let us first of all look carefully at the drainage system in Broadbalk field, and see to what extent the discharge from the pipes will represent the general percolation through the soil.

Each plot in Broadbalk field is approximately 25 feet wide, and is thrown by the plough into two "lands"; the drain-pipe lies under the furrow between these two lands at a depth varying from 2 to 2½ feet, or a mean depth of 27 inches. The following figure (fig. 31) shows in the centre a section of one entire plot with its drain-pipe, while on each side one-half of the adjoining plot is seen.

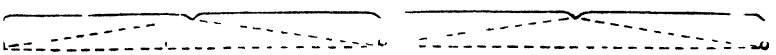


Fig. 31.—*Drain-pipes in Rothamsted Experimental Wheat-field.*

The sloping dotted lines show the general limits within which the supply of drainage-water to the pipe is drawn, though by no means all the water in the section of soil thus indicated will enter the pipe. It is at once evident that the pipe receives a great preponderance of its water from the surface 9 inches of the soil. The drainage from the second 9 inches of soil is fairly distributed between the pipe and the general percolation downwards. Of the percolation from the third 9 inches but little enters the pipe, the greater portion passing into the soil without forming part of the collected drainage water. We should gather from these data, that immediately after a top-dressing of ammonia salts or nitrate of soda has been applied, the pipe drainage would be stronger than the general percolation into the soil. As a fact, for some time after these manures have been applied, the pipe waters are strongest at the commencement of their running, and become much weaker when the running is ceasing and the water is derived from a lower stratum of the soil.[1] On the other hand, in a wet season, the pipe drainage will be weaker in late autumn and winter than the general discharge into the soil, the layer richest in nitrates and chlorides being then more than 14 inches below the surface: it is during this period of the year that the principal discharge from the drain-pipes takes place. In the greater part of the year the pipe water is strongest when the running has nearly ceased. We see from these facts that most of the runnings from the pipes, including those discharging the largest quan-

[1] Jour. Roy. Agri. Soc., 1882, p. 17.

tity of drainage water, will occur at the time of year when the pipe water is weaker than the average soil water passing below 27 inches; this, at least, must be the case when all the ammonia salts or nitrates are applied in the spring, and the autumn and winter are wet. At Rothamsted, however, since 1884, 100 lb. of the ammonia salts have been always applied to the land when the wheat is sown in October.

While the considerations just mentioned leave it somewhat doubtful whether the discharge from the drain-pipes is on an average weaker than the general discharge through the soil, there remains one other fact which strongly turns the balance of the evidence in this direction. The drain-pipe lies immediately below the furrow dividing the two lands. This wide furrow, during heavy rains, receives much surface water from the neighbouring lands, and the drain-pipe lying immediately below this head of water must receive during heavy rain a direct supply of much diluted drainage water.[1] We conclude. therefore, that the average proportion of nitrates and chlorides in the pipe drainage water during a whole season is less than in the water percolating at the same time into the subsoil.

If this be so, all estimates founded on the composition of the pipe drainage should be too low. A confirmation of this view is furnished by the facts known respecting the chlorides in the drainage water. Chlorides form part of the ammonia salts applied annually as manure. We know exactly, for instance, the quantity of chlorine annually applied to plot 10 in the ammonia salts and by rain. The quantity removed in the crop is also fairly well known, and is inconsiderable. The chlorides are perfectly soluble, and are carried by rain into the subsoil. The present writer, many years ago, calculated the total quantity of chlorine represented by all the discharges of some of the drain-pipes during periods of one or more years, at the beginning and end of which periods the drainage water contained a similar proportion of chlorides. The quantity of chlorine calculated from the composition of the drainage waters was always distinctly less than that known to have been applied to the land during the same periods and not appropriated by the crop. This deficiency in the contents of the drainage waters appeared, although their strength had been exaggerated by using the arithmetical mean of the analyses of the drainage water to represent its composition, and by assuming that the total downward percolation of water in the wheat field was the same as that through the bare uncropped soils of the drain-gauges. The conclusion to be drawn is that the discharge from the drain-pipes is on an average weaker than the general discharge into the subsoil.

[1] Jour. Roy. Agri. Soc., 1881, p. 340.

If we take these old, and apparently not exaggerated, estimates of the quantity of nitrates annually passing out of the surface soil in the percolating water, and deduct from them the quantity finally passing into the chalk, we are brought face to face with a considerable balance which disappears in the soil; it is either taken up by the roots of the crop, or is destroyed by the well known process of denitrification. We will assume, for the purpose of our calculation, that one-quarter of the percolating water escapes by the drain-pipe and is entirely lost, and that three-quarters of the drainage passes into the subsoil below the drain-pipes. This three-quarters, in the case of plot 7, would contain, on an average, according to Sir J. H. Gilbert's estimate, 23·3 lb. of nitrogen as nitrates. From this we have to deduct three-quarters of the amount which would annually pass into the chalk if there was no drain-pipe in the soil (p. 169); the balance remaining after this deduction is 15·4 lb. This amount plainly disappears after passing below the upper 18 inches of soil. If we deal with the results furnished by other plots in a similar way we arrive at the following figures:—

*Estimated Quantities of Nitrogen as Nitrates which disappear while passing through the Subsoil.*

| | Manuring | Nitrogen as nitrates lb |
|---|---|---|
| Plot 5. | Ash constituents only . . . . . | 7·4 |
| " 6. | Ash constituents and ammonia salts, 200 lb. . . | 9·2 |
| " 7. | Ash constituents and ammonia salts, 400 lb. . . | 15 4 |
| " 8. | Ash constituents and ammonia salts, 600 lb . . | 18 9 |
| " 9. | Ash constituents and nitrate of soda, 550 lb. . . | 16 1 |

We next ask, What is the probable cause of the disappearance of these nitrates? On the assumptions made they could not be carried in a normal season below 44 inches from the surface. It is, of course, quite conceivable that more or less of this nitrate is assimilated by the roots of the next wheat crop, but the evidence for a very considerable loss of nitrates on some of these plots is so strong that we incline to believe that the principal part of the nitrate in question disappears because it undergoes denitrification during the autumn and winter months, the nitrogen returning to the atmosphere as gas. Denitrification requires the presence of easily fermentable organic matter, and of sufficient water to fill the pores of the soil for a time and thus exclude atmospheric oxygen. The zone of denitrification in the wheat field will lie just beneath the drain-pipes, rising somewhat higher in the interval between them. Here the soil will from time to time be saturated with water for considerable periods, while above it lie the vegetable remains of wheat-stubble and weeds which have been ploughed in.

The season of 1881-82 furnishes us with the fullest details available as to the production and apparent waste of nitrates in the soils of the wheat field. The following table shows the alterations in the composition of the drainage water from the drain-pipes of four principal plots during the whole of this season; a few of the runnings are omitted in order to bring the results into a small compass:—

NITROGEN AS NITRATES PER MILLION OF DRAINAGE WATER, ROTHAMSTED WHEAT FIELD, 1881-82.

| Plot | 1881. | | | | | 1882. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Aug. 30 | Sept 25 | Oct 23 | Nov 27 | Dec 17, 18, 20, 21 | Jan 9 | Mar 1 | April 29 | May 6 |
| 5 | 1·4 | 6·0 | 9·5 | 7·3 | 5·0 | 3·9 | 2·4 | 0·0 | 0·0 |
| 6 | 1·9 | 7·0 | 13·3 | 8·8 | 6·2 | 6·2 | 7·7 | 0·2 | trace |
| 7 | 4·1 | ... | 18·5 | 11·7 | 7·[illegible] | 7·2 | 14·4 | 1·7 | 0·6 |
| 8 | ... | | 23·0 | 18·2 | 11·2 | 10·2 | 14·1 | 9·3 | 6·2 |

The harvest in 1881 was early, the wheat being cut on August 8-11. The first running of the drain-pipes took place on August 30. We learn from the composition of the runnings that the upper soil of plots 5 and 6, and possibly also that of plot 7, was presumably nearly free from nitrates at harvest, the first running of the pipes after harvest containing but little nitrate. The amount of nitrate rapidly increased from the subsequent rain and tillage, the maximum being reached in October, when also the samples of the upper soil were taken. The quantities of nitrates found in these soils have been given on p. 163 The autumn and winter were rather wet, the drainage through the drain-gauge amounting to 10·3 inches in the five months, September to January, during which the drain-pipes ran. The ammonia salts were applied as a top-dressing to plots 6, 7, and 8 on February 23, in the quantities already mentioned. The drain-pipes next ran six days after the application of the ammonia salts; the nitrates then showed some increase where the ammonia had been applied. The next runnings are two months later. On May 6 there is no nitrate in the water from plot 5, a trace only in the case of plot 6, and only 0·6 per million in the case of plot 7; the water of plot 8 still contains a notable quantity of nitrate.

If we are to form any correct idea of the quantities of nitrates formed and lost during this season, we need to know not only the quantities of nitrates contained in the drainage waters, but also the quantities of nitrates in the soils after the drain-pipes ceased to run. In March 1882 samples were taken of the

upper 27 inches of the soils in the adjoining barley field, and the nitrates present were determined. As two plots in this field had received for about thirty years the same quantities of manure as plots 5 and 6 in the wheat field, we are able to form a tolerable idea of the quantities of nitrates present at this date in the wheat plots 5 and 6, and to make a shrewd guess as to the quantity present in plot 7. Our first statement then runs thus, the quantities of nitrates in the drainage waters being calculated in the manner already described:—

*Nitrogen as Nitrates in Soils and Drainage Waters, formed, utilised, and lost between Harvest* 1881 *and Harvest* 1882, *in lbs. per Acre.*

| | Plot 5<br>lb. | Plot 6<br>lb. | Plot 7.<br>lb. |
|---|---|---|---|
| In drainage water passing to, or below, 27 inches, between harvest 1881 and March 1882 | 13·2 | 17·5 | 24·1 |
| In upper 27 inches of soil, March 1882 . | 18·4 | 22·8 | [27·0] |
| Formed in upper soil since harvest 1881 . | 31·6 | 40·3 | 51·1 |

If we next assume, as before, that one-quarter of the percolating water is lost through the drain-pipes, and that three-quarters of the percolating water passes below 27 inches, and displaces into the chalk a corresponding volume of water of the strength in nitrates indicated by the analyses of the deeper subsoils, we are able to deduct certain estimated losses. Our next item is the nitrogen applied as ammonia salts to the land on February 23. Our last item is the quantity of nitrogen contained in the crop finally produced. The account now stands as follows:—

| | Plot 5.<br>lb. | Plot 6.<br>lb. | Plot 7.<br>lb. |
|---|---|---|---|
| Formed in upper soil since harvest 1881 . | 31 6 | 40·3 | 51·1 |
| Lost by pipe and subsoil drainage . | 5·3 | 10·8 | 15·8 |
| Remaining for crop in soil and subsoil . | 26 3 | 29·5 | 35 3 |
| Ammonia salts applied Febuary 23 | ... | 43·0 | 86·0 |
| Total for crop . . | 26·3 | 72·5 | 121·3 |
| In crop 1882 . . | 16·1 | 33·4 | 56·1 |
| Surplus, used or lost . . . . . | 10·2 | 39·1 | 65·2 |

We must recollect that if the absence of nitrates in the drainage water from the pipes is to be taken as evidence of its absence in the upper 27 inches of soil, the whole of the production and disappearance of nitrates now in question has taken place between the harvest of 1881 and May 1882, at both which dates the drainage waters of plots 5 and 6, and probably 7, were practically free from nitrates. We must also bear in

mind that the nitrates formed in the soil are apparently underrated, since we have no account of the quantity formed in the soil between March 1882 and harvest.

It may be here remarked that the 31·6 lb. of nitrogen as nitrate estimated to have been produced on plot 5 agrees fairly well with the amount yielded by the unmanured soil, 20 inches deep, of the drain-gauge. In a season of average rainfall the quantity of nitrates annually discharged from the drain-gauge soil, which has now lain as bare fallow for over thirty years, is equal to about 32 lb. of nitrogen per acre. We should certainly expect more nitrates to be formed on plot 5 than in the soil of the drain-gauge, as the wheat soil is ploughed annually, while that of the drain-gauge is left untouched, and we have just noticed that our estimated production for all the plots must be somewhat below the truth.

The amounts of nitrate remaining at present in our reckoning unaccounted for are, as already remarked, really larger than the figures just given. What form has this nitrate taken? On one point we may be confident. A part has been made use of to form vegetable produce which is not included in the harvested crop. Besides the corn and straw harvested, a residue of roots, leaves, and stubble remains in the soil after harvest, and also a residue of weeds which is probably still richer in nitrogen; the whole of this is ploughed into the soil before wheat is again sown.

If the percentage of nitrogen in a soil is to be maintained unaltered from year to year, the annual increment of nitrogen from the residues left by the crop and weeds, plus the gain from the atmosphere and any further addition, must be equal to the annual waste of soil nitrogen by nitrification. Thus, if the soils of plots 5, 6, and 7 are to maintain their condition, nitrogenous matter must be added to the soil to replace the 31·6 lb., 40·3 lb., and 51·1 lb. of nitrogen taken from soil capital and transformed into liquid assets during the year. In fact, however, two of these three soils are not maintaining their condition.

The present manuring of the three plots in question began in 1852; previously to this date the soils had been treated in a similar manner—the average produce of wheat on plots 5 and 7 was, in fact, almost identical during the six years preceding 1852; the mean produce for this period was in each case 32 bushels. The condition of plot 6 was a little lower. We may assume, then, that the soils of the three plots were in 1852 of nearly similar composition. Since this time plot 5 has received no nitrogenous manure, and its average produce has been only 15 bushels; plot 6 has received annually 200 lb. of ammonia salts, and yielded an average produce of 24 bushels; plot 7 has received 400 lb. of ammonia salts, and given an average pro-

duce of 33 bushels. In 1893 the percentage of nitrogen in the upper 9 inches of these soils was carefully determined; it was found that the soil of plot 6 contained 244 lb. of nitrogen per acre more than plot 5, while in the case of plot 7 the excess over plot 5 reached 542 lb. It is quite possible to interpret these figures in more ways than one; but the simplest assumption, and one very near the truth, is to regard plot 5 as having lost 542 lb. of nitrogen during the forty-one years in question, plot 6 to have lost 244 lb., while the soil of plot 7 has maintained its original composition. The average annual loss on plot 5 would thus be 13·2 lb., and on plot 6, 6·0 lb. of nitrogen. On these two plots, therefore, we need not assume that the residue of roots, stubble, and weeds at harvest must be sufficient to replace the whole of the nitrates which have been formed out of soil substance in the past year,—the lost nitrogen is, in fact, only partially replaced, as the soils are in each case becoming poorer.

To calculate how much nitrogen must be replaced every year by means of crop and weed residue, we need also to know what other sources of nitrogen the soil possesses. At Rothamsted the wheat used as seed, and the annual rainfall, will supply about 7 lb. of nitrogen per acre; it is quite likely, however, that the atmospheric supply is considerably greater than the amount contained in the rain.

Putting now these figures together we arrive at the following results. Figures which we believe to be too low, for reasons already given, are marked +.

| | Plot 5. lb | Plot 6 lb | Plot 7. lb |
|---|---|---|---|
| Formed in soil since harvest 1881 . | 31·6+ | 40 3+ | 51·1+ |
| Taken from soil capital or supplied as seed and rain | 20·2+ | 13·0+ | 7·0+ |
| Replaced by crop, weed, or manure residues | 11 4 | 27·3 | 44·1 |
| Available from previous account . . | 10 2 | 39·1 | 65·2 |
| Finally left unaccounted for . . | −1·2 | 11·8 | 21 1 |

As the crop and weed residue have derived their nitrogen from the nitrates in the soil, the amount of nitrogen assumed to be present in crop and weed residue should not exceed the amount of nitrates shown by the calculation as available for their production; in the case of plot 5 we need, according to the conditions assumed, 1·2 lb. more nitrogen as nitrates than is actually available. This is not a large error, and would disappear if the loss through the drain-pipe were less than the quarter of the whole drainage, or the gain from the atmosphere somewhat greater than has been assumed.

The case becomes different when we turn to the plots annually manured with ammonia salts. Looking at plot 7, where the facts are more strongly marked, we see, in the first place, that

we have to assume a most liberal return of nitrogen to the soil in the form of crop and weed residue. It certainly seems improbable that the stubble, fallen leaves, roots, and weeds left at harvest should contain nearly as much nitrogen as is contained in an average crop, and it seems more likely that some of the nitrogen of the soil converted annually into nitrates is replaced, not by crop and weed residue, but directly from the manure. This is merely a suggestion, which must be left for further investigation to contradict or affirm. According to Berthelot, ammonia readily combines with humus, forming a compound of an amide nature; such a compound would probably yield nitrates only when the humus itself suffered chemical decomposition. If such a conversion of some of the ammonia into an insoluble and temporarily inert body takes place soon after the ammonia salts have been applied to the land, it will help us to understand the very remarkable disappearance of nitrates from the drainage-waters in early summer, and also the manner in which the nitrogenous capital of the soils on plots 6 and 7 is maintained.

Our account of the production and utilisation of nitrates on the three plots concludes with the figures showing the quantity which remains finally unaccounted for, and which has apparently been lost; this quantity amounts to about 27 per cent of the ammonia applied as manure on plot 6, and to nearly 25 per cent of the double dressing of ammonia on plot 7.

The serious losses now before us are probably due to more than one cause. In the cases in question the ammonia salt is applied as a top-dressing, and as the surface soil contains a small amount of chalk, it is possible that some ammonia is lost as carbonate before the salt is washed into the soil by rain; and it is a fact that in the barley field, where the ammonia salts are ploughed into the ground as soon as spread, the return yielded by ammonia salts is much nearer to that yielded by nitrate of soda than in the wheat field where the ammonia salts are simply top-dressed. We have already referred to the probable occurrence of denitrification in the zone immediately below the drain-pipes; this would, of course, take place only in wet weather. I would suggest, however, the possibility of another source of loss. The disappearance of nitrates from the drainage waters in summer time is a very remarkable fact when we regard the large amount of nitrates previously present in the soil. In the year we have under consideration (1882), the ammonia salts were spread upon the land on February 23, and heavy rain followed on February 28, so that the salt was quickly washed in. The rainfall in March and April was 5·5 inches; the distribution of the salt through the upper soil was thus effectively carried out, and during these two months ample opportunity was given for the nitrification of the ammonia. On

plot 7 the ammonia salt had supplied 86 lb. of nitrogen, and with the quantity of nitrogen as nitrates already in the soil, there must apparently have been something like 100 lb. of nitrogen as nitrates in the upper soil available for the wheat crop. During April the nitrates in the drainage water rapidly diminished, and on May 6 the nitrates had almost disappeared; what has become of them? Apparently they have been taken up by the wheat crop, which, however, had not by that time attained any great size. At harvest we find in the wheat crop about 56 lb. of nitrogen, to which, of course, we should add the amount contained in the roots, leaves, stubble, and weeds left on the ground. Can we thus account for the nitrogen in question? Is there not here an apparent loss of nitrogen taking place in the growing wheat plant? The question certainly invites investigation.

Our study of the evidence afforded by the Rothamsted wheat field as to the production and ultimate destiny of the nitrates in the soil has now reached its conclusion. To make clear the various stages of the argument, estimates of the quantities involved have been from time to time introduced; we cannot expect that these estimates have been in every case correct. We have obtained, however, a number of highly suggestive results, and it may be hoped that the discussion of the various questions has left them in a clearer and more definite condition for future workers. As the last survivor of the original group of workers on this subject I have studied with much pleasure the results recently published in Dr Dyer's lectures, and have sought in the present paper to connect these new results with the facts previously ascertained, and to carry on the earlier lines of thought into the new regions of fact opened up by the analyses of the deeper subsoils.

It is to be regretted that we have no recent published records of the composition of the drainage water from plots 9 and 16 in the Rothamsted wheat field, which have now received for many years a definite manuring with nitrate of soda; we have thus not been able to discuss adequately the effects of this manuring, and compare its results with those given by ammonia salts. It is still more to be regretted that no inquiry has yet been made as to the quantity of nitrates in the deeper subsoil below the dunged plot in the wheat-field. The figures in the table on p. 163 show that the upper 27 inches of this soil contain in the autumn more nitrates than almost any other soil in the field; the older analyses of the drainage waters show, however, but little nitrate passing away in this form. The important questions connected with this plot will doubtless soon receive the attention which they deserve.

# MILK RECORDS.

## SECOND SEASON—Giving the yield in Milk and Butter-fat of 389 Cows.

By JOHN SPEIR, Newton Farm, Glasgow.

THE principal object of these records, as stated in the 'Transactions' of 1904, was to enable the owners of the herds tested to make a better selection than they could otherwise do, of the most and least profitable animals in their herds.

The work of season 1903 was faulty in respect that the records were carried on for too short a period. In 1903 testing began in the first week in May at three different stations, and continued for twenty-six weeks. In 1904 it began in the last week in April, and continued for thirty weeks.

The work in 1904 was carried on under the auspices of only one association—viz., the Ayrshire Agricultural Association—at twelve farms, extending from the seashore at Maybole through the parish of Symington inland. All the farms are cheese-making ones, and consequently the bulk of the cows calved in March and April. The following are the owners of the herds tested, &c.—viz., Mr Alex. Cross of Knockdon, Cassillis; Mr W. Gray, Shanter, Maybole; Mr D. Hodge, Bogwood, Mauchline; Mr J. Hunter, Fulton, Monkton; Mr H. Hunter, Mossbog, Mauchline; Mr And. Marr, Blackbyres, Maybole; Messrs R. & J. Marshall, Turnberry, Maybole; Mr James Millar, Burnbank, Symington; Mr H. Nairn, High Langside, Kilmarnock; Mr A. M. Stevenson, Janefield, Symington; Mr Allan Stevenson, Parkhill, Mauchline; Mr Alex. Wyllie, Mossgeil, Mauchline.

The total number of cows of which a full record is given is 389. In addition to these there were on nearly all the farms several cows which had calved in autumn or winter, and which went dry in the middle of the testing period. On nearly every farm one or more cows were sold, or became unwell, or died; and in all cases where the testing did not extend over two-thirds of the whole period, or for twenty weeks, the milk yield of the animals is not recorded in the tables accompanying this report. They are, however, given in the books left at each farm, so that if necessary they may be referred to at any future date. For this reason many of the farms are credited with a number of cows considerably less than that usually in the herd.

During the whole period the recording was under the charge of Mr Wm. G. M'Leary, who had been trained at the Dairy School, Kilmarnock. While a considerable proportion of the cows were dry or nearly so when the testing stopped at 15th

November, the majority of the cows had been calved for several weeks before it began.

In order to get as complete a record as possible of the yield of each cow, testing should be carried on for the whole year, or failing that, it should begin with what cows are calved not later than the 1st March, and go on till near the end of November. This period of nine months would cover the milking period of most of the cows in cheese dairies, and it is to be hoped that the Ayrshire Association will see their way to begin earlier in future.

Among the cows tested there are a great number of exceedingly heavy milking cows, which, if they had been reported on for the whole period of lactation, would have given a yield of milk and butter-fat which would have "boomed" the Ayrshires all over the world. By recording the yield for a portion of the milking period only, breeders of Ayrshires are hiding their light under a bushel, as foreigners will observe the total yields only, and will not take note of the short period reported on.

Ayrshires of certain strains have been exported freely, and at least in some of the countries to which these have gone there is a prevailing opinion that the Ayrshire has a very short milking period. This method of keeping the milk records for six or seven months will tend to confirm those people in that opinion, and that Ayrshire breeders keep records for short periods for a particular purpose. Everywhere abroad where milk records have been kept, they have generally been carried on continuously from year to year, so that here a strong endeavour should be made to carry them over the whole period of lactation at least, even in cheese-making dairies.

Few people doubt the immense value of properly kept milk records to the ordinary breeder of dairy cattle; but up to the present time little information has been available indicating distinctly what had been the gain resulting from their adoption. As stated in the 'Transactions' for 1904, Denmark has carried on the co-operative system of milk records longer than any other country; and when in that country last summer I made it part of my business to find out what information was available on this point. I found that the present system was begun in the parish of Vejen, in South Jutland, in 1895, and that while one recorder was sufficient to carry on the work for the first two years, two have been employed constantly since 1897.

Through the assistance of several friends I procured copies of the records for each herd for the first eight years, and am promised a complete set of the ten years, which were finished at 31st December 1904.

In the parish of Vejen the cows in great part depend not only on the bulky food produced on each farm, but also on the

home-grown grain, which is mostly consumed on the farms where grown. The consequence is that the number of cows on these farms now and in 1895 is almost identical, while the method of feeding and the food available differ only to a trifling extent. These farms, to which the following tables refer, are therefore eminently suitable for judging what advantage has been gained from their milk records:—

## TABLE I.

## VEJEN MILK RECORD ASSOCIATION.

(The first Association to start testing Cows in Denmark on the present co-operative system.)

| | | | | | Farm S. | | Farm P. | | Farm I. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Gallons of milk * | Per cent of fat | Lbs of butter | No of cows | Gallons of milk | Per cent of fat | Gallons of milk | Per cent of fat | Gallons of milk | Per cent of fat |
| Year testing began | 1895 | | | | 1895 | | 1897 | | 1895 | |
| Average of the first two years | 670 | 3·30 | 245 | 298 | 477 | 3·35 | 574 | 3·39 | 617 | 3·0 |
| Yield of 1903 | 730 | 3·42 | 277 | 495 | 560 | 3·43 | 836 | 3·28 | 867 | 3·37 |
| Increase | 60 | ·12 | 32 | | 283 | ·08 | 262 | 11 | 250 | 37 |
| Value of the increase at 6d per gallon | 30s | | At 1s 32s | | 141s | | 131s | | 125s. | |

The following societies have had the undernoted increases, on an average, over all their members' herds between 1898 and 1903:—

## TABLE II.

| Farm | | Gallons of milk | Lbs. of butter |
|---|---|---|---|
| A | in five years had an increase per cow of | 67 | 31¼ |
| B | " " | 105 | 43 |
| C | " " | 72 | 35 |
| D | " " | 114 | 49 |
| E | " " | 130 | 54 |
| F | " " | 140 | 82 |
| G | " " | 148 | 54 |
| H | " " | 137 | 42 |
| I | " " | 107 | 48 |
| Average of nine parish associations | | 101 of gain. | 46½ |
| Gain, calculating the milk at 6d. per gallon and butter at 1s. per lb. | | 50s. 6d. | 46s. 6d. |

* For all the tables in this report, 1 gallon of milk has been reckoned as equal to 10 lb. imperial.

In Denmark there are now something like 400 parish societies, the oldest of which is only ten years old. They increase daily, and all of those which have gone a similar length of time show somewhat similar increases. Since dairying began in Denmark no class of experimental work has been so popular as the milk records, which in that country are invariably carried on during the whole year.

Mr Axel Appel, Stats consulent i husdyrbrug at Aarhus, with whom I have been in more or less constant communication for about twenty years, gives me the following as increases which have occurred on representative farms of three different sizes :—

TABLE III.

FARM A.

| Year | No of cows. | Average yield of milk in lbs | Average yield of butter in lbs. |
|---|---|---|---|
| 1900 | 11 | 6627 | 235 |
| 1901 | 9 | 7611 | 287 |
| 1902 | 11 | 6978 | 281½ |
| 1903 | 11 | 8094 | 317½ |
| Average increase | | 1467 | 82½ |

FARM B.

| Year | No of cows. | Average yield of milk in lbs | Average yield of butter in lbs. |
|---|---|---|---|
| 1900 | 15 | 6932 | 247 |
| 1901 | 15 | 7077 | 264 |
| 1902 | 15 | 7211 | 277 |
| 1903 | 16 | 7504 | 292½ |
| Average increase | | 572 | 45½ |

FARM C.

| Year | No of cows. | Average yield of milk in lbs | Average yield of butter in lbs. |
|---|---|---|---|
| 1900 | 71 | 6690 | 236 |
| 1901 | 69 | 6908 | 248 |
| 1902 | 70 | 7001 | 252½ |
| 1903 | 73 | 7068 | 260 |
| Average increase | | 378 | 24 |

Thirty years ago the Jutland was the beef breed of Denmark, since then, by persistent selection, it has been turned into a very good dairy breed. What has been done in Jutland can be far exceeded by judicious selection of the Ayrshire. It does not follow that where a milk record scheme has been in use, it may be for years, that breeders should throw aside all their ideas of beauty and size in an animal, and slavishly select their breeding animals according to the figures of the milk record sheets only. The day is far distant when Scots breeders will adopt such a

mechanical course, but they will undoubtedly gain by making a judicious blend of the two.

## TABLE IV.

GIVING PARTICULARS OF THE FIVE HEAVIEST MILKING COWS WHICH HAVE CALVED BETWEEN 1ST MARCH AND 31ST MAY. THE YIELD OF EACH COW IS FOR THIRTY WEEKS ONLY.

| Letter for the farm | No of the cow | Age of the cow. | Date of last calving | Total galls. of milk. | Average % of fat | Galls. of milk of 3% fat. | Value of the produce at 5d. per gall. £ s. d. |
|---|---|---|---|---|---|---|---|
| E | 10 | 6 | March 29 | 788 | 4·25 | 1117 | 23 5 5 |
| B | 36 | 8 | April 20 | 841 | 3·87 | 1086 | 22 12 6 |
| F | 40 | 7 | May 9 | 800* | 3·87 | 1033 | 21 10 5 |
| E | 33 | 13 | April 23 | 767 | 4·02 | 1029 | 21 8 9 |
| D | 1 | 6 | March 26 | 799 | 3·63 | 999 | 20 16 3 |
| Average | ... | ... | ... | 799 | 3·95 | 1053 | 21 18 9 |

* For 28 weeks, if milked for 30 weeks it would probably have yielded about 20 gallons more.

The above five cows have practically all given 1000 gallons or over of milk of 3 per cent of fat in thirty weeks, which undoubtedly shows the possibilities of the breed. As will be noticed, most of the cows were calved a considerable time before testing began, and it is to be regretted that it is not possible to give the complete yield of these cows. They are represented by four farms fairly well scattered over the part of the county covered by the Association. Hitherto many breeders, known to have good milking stocks, have hesitated to join any of the milk record associations, under the belief that their cows would not compare favourably with others on farms of a better quality than their own. Both last year's records and those of this year clearly indicate that the heaviest milking cows are not on the highest rented farms. No cow can be expected to milk satisfactorily which does not receive a sufficiency of suitable food; but it is clear that heavy milking cows must be bred, as they cannot be created out of ordinary or poor milkers by any amount of feeding. On pasture where the food of all is alike, and where the poor milker eats probably almost as much as the good milker, a gallon of milk from the former must cost double, if not triple, what it does from the latter.

## TABLE V.

Giving Particulars of those Cows which have in 30 Weeks yielded Milk of less value than £8, and have Calved between 1st March and 31st May.

| Letter for the farm. | No. of the cow. | Age of the cow. | Date of last calving | Total galls. of milk. | Average % of fat. | Galls. of milk of 3% fat. | Value of the produce at 5d. per gall. £ | s. | d. |
|---|---|---|---|---|---|---|---|---|---|
| J | 6 | 4 | May 12* | 297 | 3·26 | 323 | 6 | 14 | 7 |
| K | 19 | 3 | May 1† | 318 | 3·36 | 356 | 7 | 8 | 4 |
| I | 24 | 3 | March 3 | 336 | 3·23 | 362 | 7 | 10 | 10 |
| J | 4 | 4 | March 25 | 380 | 2·92 | 370 | 7 | 14 | 2 |
| Average | ... | . | ... | 333 | 3·18 | 353 | 7 | 7 | 1 |

* Dry after October 24. † Dry after October 5.

## TABLE VI.

Giving 10 per cent of each Herd of those Cows giving the Highest and Lowest Yields of Milk. Cows only have been taken which calved after 1st March or before 31st May. Two-year-old Heifers have been excluded.

| Farms. | Cows in the herd | No reported on. | Average date of calving. | Total milk in galls. | Average % of fat. | Galls of milk of 3% fat. | Heaviest milkers. £ | s. | d | Lightest milkers £ | s. | d. | Average age. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | 36 | 4 | March 30 | 740 | 3·95 | 975 | 20 | 6 | 3 | | | | 8¾ |
| | | 4 | April 12 | 493 | 3·36 | 553 | | . | | 11 | 10 | 5 | 4½ |
| D | 29 | 3 | March 18 | 733 | 3·85 | 949 | 19 | 15 | 5 | | | | 5⅓ |
| | | 3 | " 24 | 403 | 3·68 | 493 | | | | 10 | 15 | 5 | 6 |
| B | 39 | 4 | April 1 | 790 | 3·58 | 944 | 19 | 13 | 4 | | . | | 6½ |
| | | 4 | " 13 | 484 | 3·41 | 550 | | | | 11 | 9 | 2 | 6½ |
| F | 40 | 4 | " 23 | 644 | 4·00 | 859 | 17 | 17 | 11 | | . | | 7 |
| | | 4 | " 4 | 350 | 3·51 | 410 | | | | 8 | 10 | 10 | 3¾ |
| I | 33 | 3 | " 11 | 680 | 3·75 | 850 | 17 | 14 | 2 | | | | 8⅔ |
| | | 3 | March 28 | 349 | 3·60 | 419 | | | | 8 | 18 | 7 | 5⅜ |
| K | 34 | 3 | ... | 621 | 4·11 | 850 | 17 | 14 | 2 | | ... | | 7 |
| | | 3 | . | 318 | 3 39 | 359 | | | | 7 | 9 | 7 | 5 |
| L | 35 | 3 | March 31 | 655 | 3 82 | 835 | 17 | 7 | 11 | | ... | | 8 |
| | | 3 | " 9 | 472 | 3·42 | 538 | | | | 11 | 4 | 2 | 8 |
| G | 36 | 4 | " 26 | 618 | 3·62 | 746 | 15 | 10 | 10 | | . . | | 6½ |
| | | 4 | April 18 | 413 | 3·55 | 490 | | | | 10 | 4 | 2 | 3¼ |
| A | 25 | 2 | " 12 | 620 | 3·52 | 727 | 15 | 2 | 11 | | | | 9 |
| | | 2 | March 20 | 317 | 3·74 | 458 | | | | 9 | 10 | 10 | 3 |
| C | 36 | 4 | April 9 | 581 | 3·75 | 726 | 15 | 2 | 6 | | .. | | 8 |
| | | 4 | " 1 | 396 | 3·44 | 454 | | | | 9 | 9 | 2 | 3¾ |
| H | 21 | 2 | " 11 | 494 | 4·01 | 661 | 13 | 15 | 5 | | ... | | 4½ |
| | | 2 | March 3 | 426 | 3·23 | 459 | | . | | 9 | 11 | 3 | 10½ |
| J | 25 | 2 | " 14 | 542 | 3·56 | 645 | 13 | 8 | 9 | | | | 8 |
| | | 2 | April 1 | 338 | 3·07 | 346 | | | | 7 | 4 | 2 | 4 |
| Average of 10% of the heaviest milking cows | ... | 38 | . . | 643 | 3·80 | 814 | 16 | 19 | 2 | | ... | | . . |
| Average of 10% of the poorest milking cows. | . . | 38 | | 396 | 3·48 | 461 | | . | | 9 | 12 | 1 | |

The cows on Table V. are probably the most unprofitable of those tested in 1904. On the average they yield only one-third of the milk that the best five do. The two poorest milkers only continued in milk for a little over five months, while the lactation period of a good milker is usually about double that length of time. In order to give a good milk yield, a cow must not only milk for at least nine months, but she must give a fairly steady quantity for almost two-thirds of that time. The cow giving a big quantity after calving, and dropping off very rapidly soon after, rarely has a very big yield.

Table VI. is well worthy of the careful consideration not only of the owners of these herds but of all interested in the subject.

### *Heavy* versus *Poor Milkers.*

The remark was made on p. 178 of the 'Transactions' of 1904 that there was a common belief that heavy milking cows did not give milk yielding so much butter-fat as those of more moderate yield. On the following page it was shown that, at least as far as 10 per cent of the most profitable cows of 1903 were concerned, this did not apply, as they gave milk with ·34 per cent of fat more than the same number of the least profitable cows. These figures were the average of 180 cows, and were therefore likely to give a fairly reliable average. These remarks apply to the same class in 1904, the difference last year on an average of 76 cows being ·32 per cent of fat in favour of the heavy milkers. The figures for both years are wonderfully close, considering that the cows were almost entirely different from those of the year before.

In 1903, 10 per cent of the best cows gave an average of 227 gallons more milk than the poor ones over a period of 28 weeks. In 1904 the same class of cows gave an increase of 247 gallons over a period of 30 weeks. If allowance is made for the longer period during which the testing lasted in 1904, it is found that the results of the two years corroborate each other very closely.

As will be noticed by a perusal of the table, when 10 per cent of the heaviest and poorest milking cows are taken, the poor ones give milk of little more than half the value of the better ones. The question here arises, Do these poor milkers pay to keep? I fear they are like the razors that were made to sell, not to shave; so these cows are reared to sell and not to milk. Some of them have, no doubt, been reared in the expectation that they might be profitably sold when young, but this desired consummation not having been brought about, they had to be used at home. What has been the result? Compared

with the better lot, their owners have almost lost as much in a single season as these cows yielded altogether, while the one has probably consumed as much food as the other. The difference is so great that if it were possible for a farmer to secure a stock equally as good as the average of the 10 per cent best of each stock, he would have as good a return from his cows, after paying rent and expenses, as the owner of the poorer lot would receive, although he paid neither rent nor expenses. It is probable that, like the poor, bad milking cows will always be with us; but with judicious selection there should be no difficulty in very much reducing their number.

No improvement in farming of any kind offers the same opportunities of a remunerative return as using heavy-milking cows in dairying. These can only be procured in two ways—by purchase and by breeding. Few will probably care to give the big price that an owner is justified in asking for one of these valuable cows, but if among the wealthier and more enthusiastic breeders a demand were created for them they would no doubt be forthcoming, at first probably in limited numbers, but as time went on they would naturally increase. The average man can, however, always breed a few, and by strictly limiting his breeding to his best milking cows, and his selection of bulls to sons of heavy milkers, a wonderful improvement might be produced in a few years. The possibilities of what may be effected in that direction are shown in the yields given by the best cows of the first three farms of the foregoing table. In thirty weeks 10 per cent of the cows of these farms have given almost £20 worth of milk at the rate stated, yet these cows were bred on these farms, and even the farms are not of the very best class.

What has been done on the farms indicated can be done on many others, and may be surpassed in far more instances than the public are generally aware of. The greatest hindrance to improvement in this direction is the want of knowledge among farmers of what can be done or has been done by others, and of faith in their ability to do the same or better themselves. For many years I have held that it was very questionable if the Ayrshire yielded as much on an average cheese-making farm as was done fifty or more years ago; but if breeding on the lines indicated were extensively followed, I think it would be found that the possibilities of the breed are far beyond the expectations of its most ardent admirers. Slaughter the poor milking cows, keep on and breed only from the best ones as long as they remain healthy, and these results will come about much quicker than is generally anticipated.

### *The heaviest Yields of Milk.*

There were nine occasions on which seven cows yielded over 200 lb. of milk of 1 per cent of fat, or 66⅔ lb. having 3 per cent of fat. The greatest yield of butter-fat was on June 25 and 26 on farm D, when cow No. 1 gave 257 lb. of milk of 1 per cent of fat at two milkings, equal to 85⅔ lb. of 3 per cent of fat when she was fourteen weeks calved. The heaviest yield of milk, irrespective of quality, was obtained from cow 3 of farm B on June 23 and 24, when she was six weeks calved. This cow at this date gave 66·5 lb. of milk, equal to 232·75 lb. of milk of 1 per cent of fat, or 77·58 lb. of 3 per cent of fat. It is well worthy of notice that this cow is not by any means a heavy milker, when her yield for a whole season is taken into account. She is twelfth from the top in a herd of 39, and while the total yield of her milking period is accounted for, many other less noticeable cows gave a large quantity of milk before the testing began and after it finished. If, therefore, each cow had had her milk weighed and tested for the whole period of her lactation, this cow would not have compared so well with the others as she does, owing to the short time she has continued to give milk. This cow would likely be considered one of the best cows in the herd by those milking her, but in reality she is far from it. She is one of the class of cows to be guarded against, and regarding which only a milk record scheme can give reliable information.

Of these cows there were 2 four weeks calved, which averaged 58·20 lb. of milk, equal to 213·87 lb. of 1 per cent of fat, and 1 six weeks calved, having 66·50 lb., equal to 232·75 lb. of 1 per cent of fat; 3 eight weeks calved, averaging 51·08 lb. of milk, equal to 222·17 lb. of 1 per cent of fat; 2 ten weeks calved, with 52·5 lb. of milk, equal to 227·5 lb. of milk of 1 per cent of fat; and 1 fourteen weeks calved, with 56·00 lb. of milk, equal to 257·00 lb. of milk of 1 per cent of fat.

It is very creditable to the Ayrshire breed that out of 56 heifers calving within a limited period, 10 of them should give milk of an average value of £14, 2s. 6d. in 30 weeks. In addition to the above there were several heifers on various farms which had calved in autumn or winter, yet they gave very respectable milk yields during the testing period. Had the testing been continued for a whole year, as it should have been, one or two of these cows might have given a very big yield. One in particular, on farm G, No. 22, calved in October 1903, yet she milked till the middle of October 1904, and in 26 weeks, before becoming dry, she yielded 525 gallons of milk of 3 per cent fat. If she did equally well in the previous six months, she must have given a phenomenal yield for a heifer, and it will be

## TABLE VII.

### Giving Particulars of the Ten Heaviest Milking Heifers

| Farm. | No of cow | Total milk in gallons | Average % of fat. | Gallons of milk of 3% of fat. | Value of the produce at 5d per gallon | Size of the cow | Date of last calving | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | £ s. d. | | | |
| K | 17 | 585 | 3 68 | 719 | 14 19 7 | M | May 1 | This cow was almost dry at 3rd Nov, and although she has not milked long she has yielded a large quantity of milk. |
| B | 30 | 578 | 3 73 | 718 | 14 19 2 | S | April 1 | At this farm the first test was made on 28th April, and at the last one on 10th Nov. this cow gave 1¼ gallon of milk, so that her total yield is much more than is stated here |
| D | 18 | 503 | 4 13 | 697 | 14 10 5 | M | Feb 8 | This cow gave a large quantity of milk before the test began, and on 12th Nov. was still giving ¾ gallon daily, so that she is probably the heaviest milking cow of the lot |
| D | 26 | 543 | 3 78 | 684 | 14 5 0 | L | March 29 | When the testing stopped this cow was giving 1¼ gallon daily |
| E | 12 | 542 | 3 77 | 680 | 14 3 4 | M | April 5 | Yielding 1 gallon on 11th Nov. |
| B | 10 | 606 | 3·35 | 677 | 14 2 1 | L | April 11 | Yielding 1¼ gallon on 10th Nov |
| D | 8 | 508 | 3 99 | 672 | 14 0 0 | L | April 14 | Yielding 1 gallon on 12th Nov. |
| H | 32 | 492 | 4 09 | 672 | 14 0 0 | L | April 21 | This cow was yielding 1½ gallon when the tests stopped on 8th Nov, and is the heaviest milking cow in the herd. |
| E | 37 | 483 | 3 93 | 634 | 13 4 2 | M | May 3 | Yielding 1 gallon on 11th Nov |
| D | 2 | 465 | 4 08 | 633 | 13 3 9 | L | April 1 | Yielding ¾ gallon on 12th Nov |
| Average | | 530·5 | 3·83 | 678 6 | 14 2 9 | | | |

interesting to note how she does in future years. No. 2, farm L, calved 16th December, and yet yielded 604 gallons of milk of 3 per cent fat during the period of the test. It is desirable, and I hope it may be possible at some future date, to exhibit and give prizes for the best animals or herds, as proved by the milk record scheme, and if a desire is shown for such by breeders, it is possible that a beginning may be made with heifers.

The following table shows the distribution among the various farms of the ten heaviest milking heifers, and the proportion these hold to the total heifers in the herd:—

TABLE VIII.

DISTRIBUTION OF THE TEN HEAVIEST MILKING HEIFERS.

| Farm | No of heifers in the best ten | Total average milk in gallons | Average % of fat. | Gallons of milk of 3% of fat. | Heifers in the herd calving in March, April, or May. | Remarks |
|---|---|---|---|---|---|---|
| D | 4 | 505 | 3 99 | 671 | 7 | One of these calved on 3rd June. |
| B | 2 | 592 | 3·51 | 692 | 6 | ... |
| E | 2 | 512 | 3·85 | 617 | 6 | One of the two in the ten best calved on 3rd May. |
| K | 1 | 585 | 3·68 | 719 | 3 | Another of this lot calved on 1st May, and yielded 629 gallons of milk of 3% of fat. |
| H | 1 | 492 | 4·09 | 672 | 5 | The heifer in this lot did better than any cow in the herd. |

It is worth noting, as showing the value of pedigree in breeding for milk, that the 10 best heifers, out of 56 animals available for comparison, are all from five farms out of a total of twelve. These farms have not by any means the best land, clearly indicating that maximum yields of milk are to be looked for from breeding and not from feeding. A well-bred animal can only produce its maximum of milk when it is supplied with a sufficiency of food, but, as already stated,—the fact can hardly be too often repeated,—even with a sufficiency of food an ill-bred one will still remain a poor milker. It has been urged against this scheme that if cows are kept which give more milk than at present, they must eat more food. The argument is undoubtedly correct, but the excess of food eaten by a heavy milking cow compared with a poor one is trifling compared with the value of the excess of milk. In the 'Transactions' of 1904, p. 189, it was shown that the cost for food alone, as represented by the rental of the grazings of the cows in the milk record scheme of 1903, did not much exceed one penny per gallon for milk of 3 per cent of fat. It is the same cost wintering and attending a cow whether she is a good or a bad milker, consequently every gallon extra yielded must be value for from three to four times the food from which it was produced. That should be a good profit.

### *The effect of Size of the Cows on their Yield of Milk.*

From the milk record sheets of 1903 the cows were divided into three lots according to size—viz., what the recorders or the farmer to whom they belonged considered small, medium, and

large. These tables gave no indication of size having any effect on the quality of the milk; that part of the inquiry has therefore been dropped this season. As before, the cows were all divided into three classes, but only those which had calved between 1st March and 31st May were selected for this inquiry. Three-year-olds were excluded in 1903, but are included for 1904. The following table gives the yield of each lot of cows for both years:—

TABLE IX

YIELD OF MILK OF 3 PER CENT OF FAT, FROM SMALL, MEDIUM, AND LARGE COWS, FOR THE SUMMERS OF 1903 AND 1904

| Size of cows | 1903 | | | 1904. | | |
|---|---|---|---|---|---|---|
| | No reported on | Gallons of milk of 3% of fat | Length of record in weeks | No reported on | Gallons of milk of 3% of fat | Length of record in weeks |
| Small | 203 | 507 | 26 | 55 | 582 | 30 |
| Medium | 402 | 542 | 26 | 131 | 628 | 30 |
| Large | 137 | 546 | 26 | 89 | 659 | 30 |

Without making any allowance for the difference in the length of time during which the record was carried on in each year, but giving full weight to the numbers reported on, the following table gives the yield of each size of cow for the two years combined:—

TABLE X

AVERAGE YIELD OF MILK OF 3 PER CENT OF FAT, FROM SMALL, MEDIUM, AND LARGE COWS, SINCE THE BEGINNING OF THE MILK RECORD SCHEME

| Size of cows. | No of cows reported on | Gallons of milk of 3% of fat |
|---|---|---|
| Small | 258 | 523 |
| Medium | 533 | 563 |
| Large | 226 | 590 |

The yield of milk compared with the size is much more uniform in 1904 than what it was in 1903, and as the numbers increase in future years the uniformity is likely to become more constant.

### *The effect of Age on Yield of Milk.*

The milk record sheets for 1903 afforded the first opportunity which has ever occurred in Scotland of finding out what effect age had in the quantity and quality of milk yielded by Ayrshire cows. The results were tabulated for 903 cows, and are recorded on p. 182 of the 'Transactions' of 1904. Advantage was taken of the sheets of 1904 to do the same, so that by increasing the numbers more reliability might be given to the figures. The following table gives particulars of the yield of cows of each age for 302 animals which were available in 1904:—

TABLE XI.

Comparative Average Yield of Cows of different Ages calving between 1st March and 31st May, during the Thirty Weeks over which the Testing extended, or Shorter Period where the Cows went Dry at an earlier date.

| Age of the cows in years | No of animals reported on | Average yield in gallons for 30 weeks | Average % of fat in the milk. | Average number of gallons of milk of 3% of fat | Increase or decrease in gallons of milk of 3% of fat from the yield of cows a year younger | |
|---|---|---|---|---|---|---|
| 2 | 15 | 387 | 3 92 | 506 | . | |
| 3 | 56 | 446 | 3·69 | 548 | 42+ | |
| 4 | 48 | 513 | 3·56 | 609 | 61+ | |
| 5 | 39 | 514 | 3 59 | 615 | 6+ | |
| 6 | 38 | 541 | 3 60 | 649 | 34+ | Average increase per year in age = 29 gallons. |
| 7 | 30 | 560 | 3 62 | 676 | 27+ | |
| 8 | 35 | 585 | 3·59 | 700 | 24+ | |
| 9 | 11 | 587 | 3 62 | 708 | 8+ | |
| 10 | 13 | 579 | 3·52 | 679 | 29– | |
| 11 | 7 | 534 | 3 46 | 618 | 61– | |
| 12 | 2 | 510 | 3 62 | 615 | 3– | |
| 13 | 5 | 617 | 3 46 | 711 | 96+ | |
| 14 | 3 | 571 | 3·71 | 706 | 5– | |
| Total | 302 | ... | | ... | .. | |

Although the number of animals of each age in the foregoing table is comparatively small, with the exception of those of five years old, the increased yield owing to age is fairly uniform from two years up to eight years. Strange to say, in 1903 as in 1904, the increase in milk of 3 per cent of fat, of cows of five years of age, is very small compared with those of four years old. In the year 1904 it was only 6 gallons, while in 1903, with a very much larger number of animals, it was only 9 gallons. In 1903 the average increase per year from two to eight years was 18 gallons per cow per year, while this year it is 29 gallons. In 1903 the maximum yield was reached at eight years of age,

in 1904 it is nine years. In 1904 there is more decline between the ages of nine and twelve years than was the case in 1903. What seems peculiar is that for 1904 the maximum yield is given by cows thirteen years old. The number is, however, small, and on that account is unreliable. The following table gives the averages for both years:—

TABLE XII.

COMPARATIVE AVERAGE YIELD OF MILK OF 3 PER CENT OF FAT FROM COWS OF VARIOUS AGES SINCE THE BEGINNING OF THE MILK RECORD SCHEME.

| Age of the cows in years | No. of animals reported on | Average yield in gallons. | Average % of fat in the milk | Gallons of milk of 3% of fat | Increase or decrease in gallons of milk of 3% of fat, from the yield of cows a year younger | |
|---|---|---|---|---|---|---|
| 2 | 45 | 370 | 3·86 | 476·6 | ... | Average increase per year = 22 gallons. |
| 3 | 203 | 396 | 3·77 | 498·0 | + 21·4 | |
| 4 | 212 | 428 | 3·71 | 529·0 | + 31·0 | |
| 5 | 176 | 442 | 3·65 | 537·0 | + 8·0 | |
| 6 | 148 | 464 | 3·62 | 561·0 | + 24·0 | |
| 7 | 118 | 489 | 3·62 | 592·0 | + 31·0 | |
| 8 | 116 | 503 | 3·62 | 609·0 | + 17·0 | |
| 9 | 61 | 500 | 3·51 | 585·0 | − 24·0 | |
| 10 | 49 | 489 | 3·60 | 587·0 | + 2·0 | |
| 11 | 35 | 478 | 3·57 | 568·0 | − 19·0 | |
| 12 | 18 | 495 | 3·42 | 564·0 | − 4·0 | |
| 13 | 15 | 491 | 3·43 | 561·0 | − 3·0 | |
| 14 | 6 | 473 | 3·66 | 576·0 | + 15·0 | |
| 15 | 3 | 406 | 3·39 | *459·0 | −117·0 | |
| 18 | 1 | 471 | 3·74 | *587·0 | +128·0 | |
| ... | 1205 | ... | ... | . | ... | |

* These figures are those of 1903 only, and represent the yield for 26 weeks.

Taking the whole cows hitherto tested, the ages of which were known, and which had all calved within a limited period, it will be noticed that, with the exception of those of five years of age, the increase is fairly steady from two years up to eight years of age. While there has been some variation between the ages of nine and eighteen years, to all intents it has remained practically stationary, as the variations seem as if they were due more to peculiarities in individual animals than to differences in their ages. If in later years this indication should be supported by further experience, when a larger number of aged cows are available, it will be contrary to the opinion held by many breeders at the present day.

*The effect of Age on the Percentage of Fat in the Milk.*

In 1903 the three-year-olds yielded slightly richer milk than the two-year-olds, but in 1904 the latter gave milk considerably richer than the former. When the two years are combined, the milk of the two-year-olds is still the richest. The decline in quality seems to be fairly uniform from the first calf, but is so trifling that for all practical purposes it is scarcely worth considering. Taking the quality of the milk yielded by the three cows fifteen years old as the likely minimum, the variation between the richest and the poorest quality, as affected by age, does not seem to exceed ·5 per cent of fat. When this amount is spread over a period of thirteen years, it does not amount to ·04 per cent for each year of age, if the decrease in quality turns out to be uniform. With the information at our disposal it does not seem as if the decrease in quality for each year of age is likely to exceed one-half of ·1 per cent of fat.

*The effect of Period of Lactation on the Fat in the Milk.*

There is a popular belief that the milk which a cow gives the first few days after calving is the poorest of her whole period of lactation, and that from calving to going dry it gradually increases in percentage of fat. The latter part of this belief is virtually correct, but the first part is not supported by any evidence which has ever been at my disposal. When there was no means of testing milk other than by the palate, the churn, or by chemical analysis, our information regarding milk increased very slowly. After the introduction of the Babcock and other rapid methods of estimating the fat, &c., much greater progress was made. In 1893, when carrying on some experiments on the effect of food on milk and butter, and again in 1895 and 1896, when engaged on the same work, I had often occasion to test daily the milk of cows recently calved. Much to my surprise, I usually found that the milk was richer in fat three or four days after calving than ever it was till months later. This almost invariably happened with the limited number of cows with which I was then experimenting, and in not a few cases caused serious disturbance to the results of the feeding experiment. I drew attention to the fact at the time on several occasions, and repeatedly since, but few people, even among those who have been handling cows for a lifetime, seemed to think that my experience was general, and as a rule looked on it as exceptional. To come to any general conclusion regarding cows from the experience of a small number is very apt to be misleading; it therefore occurred to me that the milk records of the past season, if sufficiently analysed, would contain reliable evidence of the variation of the fat in milk during the period of

lactation. To do so for about 400 cows, or at least such of them as had calved within a limited period, was a work of considerable labour, as it necessitated the milk-yield of each cow, which had been two or any number of weeks calved, being separated from those longer calved, and all of the one period of lactation being grouped together. This was done for all the cows which calved between the beginning of March and the end of June. Those under one week calved were put into one lot, then those under two weeks, four weeks, six weeks, &c., up to fourteen weeks. The following table gives a summary of the results:—

TABLE XIII.

TABLE SHOWING THE VARIATION IN MILK DURING THE FIRST FOURTEEN WEEKS OF THE PERIOD OF LACTATION.

| Length of time calved | No of cows re ported on | Average milk in lbs | Average % of fat | Remarks |
|---|---|---|---|---|
| Under 1 week | 38 | 26·3 | 3 75 | Cows all calved between the last week in April and the first week in June. |
| " 2 " | 97 | 28·9 | 3 56 | Between first week in April and second week of June |
| " 4 " | 149 | 31 9 | 3 23 | Between last week in March and the beginning of June. |
| " 6 " | 208 | 32 1 | 3 31 | Between middle of March and the beginning of June |
| " 8 " | 243 | 32 0 | 3 32 | Between beginning of March and the beginning of June. |
| " 10 " | 221 | 32 7 | 3 34 | Between beginning of March and the beginning of June |
| " 12 " | 175 | 34 2 | 3 42 | Between beginning of March and the beginning of June |
| " 14 " | 114 | 34·1 | 3 42 | Between beginning of March and the beginning of June. |

In the above table every cow is included which calved within its respective period. It is probable that the quality of the milk yielded by those calved twelve and fourteen weeks has been slightly deflected from the normal. These cows had all calved during March, so that their period of twelve and fourteen weeks came on in June when the pasture is in its most succulent state, and the yield of milk is at its maximum. It is difficult to estimate what effect this has had on the quality, as some consider it might be lowered, while others think the reverse.

In the above table the greatest yield in weight of milk is recorded for animals about twelve weeks calved. This is, however, probably more the result of extra food than length of time calved, as these animals at that period had the advantage of the full flush of June grass.

In regard to butter-fat, the figures are quite definite as to the milk of the first week after calving, being richer in fat than any yielded for many months later. The decrease in fat seems to

be very rapid, as in one week taken over ninety-seven cows it fell ·2 per cent of fat, reaching the minimum about the fourth week. The results obtained with the small number of animals twelve years ago are almost identical with those from the larger number now reported on.

While it may be accepted as of general application that cows usually give richer milk about a week after calving than later on, it is not universally so. Although the average for the thirty-eight reported on one week after calving is 3 75 per cent of fat, one or two were as low as 3 per cent, while others were over 5 per cent of fat, and yet later on they did not seem to differ very materially, or at least they did not differ to anything like the extent they did at the end of the first week. What turned out to be several of the best herds had many cows yielding milk of a low percentage of fat a few weeks after calving. I am certain that this did not happen from accident, but is the result of some very definite cause operating over a large number of cows, and I hope that in future years some explanation of it may be forthcoming.

After the fourth week the increase of fat in the milk is slow but steady; and although fairly uniform for the number and class of cows reported on, there is no evidence that the per cent of fat continues to increase uniformly during the whole period of lactation. If there is no disturbing influence in the class of cows used, their number or food, and the rise in quality is uniform from the minimum, it seems probable that the increase is about ·02 per cent of fat per week extra. The number of animals reported on in the above table is sufficiently large, and the results obtained are sufficiently uniform, to warrant the conclusions drawn being considered reliable. Hitherto few particulars bearing on the above point have been obtainable, but those given here should form a basis for future comparison.

*One Year's Yield of Milk compared with another.*

A good many people have formed the opinion that testing cows in this manner is not worth the expense, as many cows milk well the one year and badly the next. It must be admitted that a few cows occasionally do so, but fortunately the fault is somewhat rare. A heavy milking cow in any year is much more likely to be a good one the year following than one which was only a poor or average milker, and as a breeder of good milking stock there should be no comparison. Three of the herds tested in 1904 were also tested in 1903. A large proportion of the animals tested were the same in both years, and the opportunity has been taken to compare the yields of the best and worst animals for both years.

## TABLE XIV.

COMPARISON OF THE POSITION HELD IN 1903 BY THE BEST SIX COWS OF EACH HERD IN 1904.

| 1904. | | | 1903. | | | Remarks |
|---|---|---|---|---|---|---|
| Position of cow in the list. | No of cow on byre sheet. | Gallons of milk of 3% of fat. | No. of cow on byre sheet | Gallons of milk of 3% of fat | Position of cow in the list. | |
| **FARM E.** | | | | | | |
| 1 | 10 | 1117 | 10 | 837 | 3 | |
| 2 | 33 | 1029 | 33 | 859 | 1 | |
| 3 | 24 | 955 | 24 | 840 | 2 | |
| 4 | 23 | 800 | 23 | 590 | 26 | |
| 5 | 34 | 782 | 34 | 729 | 7 | |
| 6 | 20 | 781 | 20 | 657 | 11 | |
| The smallest milking cows in this herd are probably the following :— | | | | | | |
| | 2 | 549 | 2 | 432 | | Calved in Feb in 1904 and in March in 1903. |
| | 3 | 459 | 3 | 475 | | |
| **FARM F.** | | | | | | |
| 1 | 40 | 1033 | 27 | 717 | 3 | The two best cows in 1903 were away in 1904. |
| 2 | 26 | 843 | 31 | 598 | 14 | |
| 3 | 3 | 796 | 1 | 588 | 16 | |
| 4 | 23 | 763 | 26 | 622 | 10 | |
| 5 | 36 | 725 | 45 | 555 | 23 | Calved on 1st July 1903, and last test 21st Oct. |
| 6 | 41 | 701 | 44 | 573 | 19 | Calved on 18th June 1903, and last test 21st Oct. |
| The smallest milking cows in this herd are probably the following.— | | | | | | |
| | 35 | 480 | 39 | 446 | | |
| | 12 | 519 | 15 | 410 | | |
| **FARM L.** | | | | | | |
| 1 | 23 | 846 | 22 | 600 | 18 | Calved a month earlier in 1903. |
| 2 | 26 | 845 | 27 | 701 | 6 | |
| 3 | 16 | 815 | 16 | 786 | 1 | |
| 4 | 20 | 797 | 12 | 722 | 5 | |
| 5 | 10 | 761 | 14 | 755 | 3 | |
| 6 | 9 | 722 | 9 | 776 | 2 | |
| On the average of the two years testing the smallest milking cows in this herd are probably the following :— | | | | | | |
| | 27 | 344 | 28 | 370 | | |
| | 18 | 424 | 18 | 488 | | |

On farm E the first three cows in 1903 are again the first three of 1904, only their position is slightly altered, as much caused probably by date of calving as anything else. The others held good positions also in 1903.

On farm F the two best cows of 1903 were not among those tested in 1904; but no information has been given of what became of them. The next best cow—viz., the third one of 1903—is naturally now the best in the herd, and in 1904 she takes that position. The others, although well up in the list in 1903, were not very near the front.

On farm L five out of the six best cows in 1903 are among the best six of 1904, which clearly indicates how little there is in the argument that a good milker the one year may be a bad one the next. As years go on and more information becomes available, I have no doubt that the whole will go to prove that the good milkers of any year are likely to be the good milkers of the following years, and if suitably mated the breeders of produce which will also be good milkers.

The worst milkers on each of these farms were bad milkers both seasons.

*The effect of Cows being in Season on Percentage of Fat.*

When cows are in season, or during the period of rutting, there is often a difficulty in getting them to let down their milk, and in many cases they do not give their usual quantity at these times. There is also a common belief that at these periods the milk is poor in fat.

The recorder had instructions to note on the byre-sheets any illness or other peculiarity in any of the cows, and during June and July he has notes opposite a considerable number of cows, that they were in season at the date of his visit. On the sheets belonging to several of the farms he has made no notes of this kind, and on several of the farms one cow only is given as being in season. The bulk of those given are on four farms, and these farms are principally those with fairly high milk-yields.

The number of cows in this condition was 27, and they gave milk with an average butter-fat of 3·55, which was equal to a full average of what the whole of the cows in the milk record scheme were giving at that date. One cow gave milk of only 2·5 per cent of fat, and another of 2·7 per cent of fat, and a third 2·8 per cent of fat; but all the others yielded milk having over 3 per cent of fat. There were 5 cows which had milk with over 4 per cent of fat, and 1 had as much as 4·7 per cent of fat. Although the number of cows reported on is not very great, yet the figures seem to indicate that when cows are in this condition few of them give milk with an abnormal low percentage of fat.

*Conclusion.*

It is to be regretted that a greater number of the farmers who were in the Ayrshire Milk Record Association in 1903 did not see their way to join in 1904. This distinctly shows that the value of this work is not yet fully realised. Where the farms are small, and no assistance is available for this work other than the grant from the Highland and Agricultural Society, one can easily understand why some hesitation should be shown in joining in the work on the score of expense. In the Ayrshire Association outlay does not come into the calculation at all, as all the expenses not covered by the Highland and Agricultural Society grant are paid by that Association. The farmers whose herds were tested had only to bear the cost of boarding the recorder and transporting him and his apparatus from farm to farm. Even at this trifling outlay three-fourths of them did not seem to consider the game worth the candle. On the other hand, one farmer who has a small herd and who had to pay his half-share of the cost, declared that the trouble and expense incurred in boarding the recorder were trifling compared with the value of the information he gave them on various agricultural matters. If this scheme is to do anything like the good it is capable of doing, it must not be carried on by fits and starts, but be pursued steadily from year-end to year-end for many years. This is the spirit in which it has been begun and is being carried on in Denmark, where in ten years from the starting of the first one, the number of societies has already increased to 400. Most of these not only test in the year they begin, but for the whole year and every year afterwards. There is no reason why the same should not be done here where the herds are larger, the assistance given by the Highland and Agricultural Society is greater, and the facilities for carrying on the work are better. All that is necessary is for breeders to realise the importance of the work and the increased profit it leads to. When they do this all will wish to join.

In 1904 no mixed sample of the milk of the morning and evening was taken and separately tested. There are still considerable differences of opinion as to the quality of evening milk compared with that of the morning, and it is to be regretted that the same procedure was not followed as in the previous year. Instructions have, however, been given for having this done in 1905.

No attempt was made, as in 1903, to get at the rental of the land grazed by the cows reported on, as it did not seem to indicate a line which was likely to yield much useful information.

## FARM A.

| | No. of cow | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 5d. per gall. £ s. d. | Age of cow. | Size of cow | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 9 cows=36 % of the herd | 6 | 639 | 3·58 | 763 | 15 17 11 | 13 | L | April 21 |
| | 15 | 600 | 3·44 | 690 | 14 7 6 | 5 | M | " 4 |
| | 25 | 562 | 3·58 | 670 | 13 19 2 | 8 | M | March 1 |
| | 16 | 646 | 3·07 | 662 | 13 15 10 | 6 | L | April 3 |
| | 20 | 527 | 3·70 | 651 | 13 11 3 | 5 | L | Feb. 22 |
| | 4 | 579 | 3·32 | 641 | 13 7 1 | 11 | L | May 5 |
| | 27 | 459 | 4·04 | 619 | 12 17 11 | 4 | S | " 10 |
| | 9 | 453 | 4·08 | 617 | 12 17 1 | 5 | M | April 3 |
| | 8 | 508 | 3·57 | 605 | 12 12 1 | 5 | M | May 12 |
| Average of . | 9 | 552 | 3·56 | 657 | 13 13 9 | 7 | . | . . |
| 8 cows=32 % of the herd. | 22 | 524 | 3·22 | 563 | 11 14 7 | 4 | L | April 8 |
| | 7 | 432 | 3 89 | 560 | 11 13 4 | 5 | L | March 10 |
| | 1 | 455 | 3 52 | 534 | 11 2 6 | 3 | M | " 19 |
| | 24 | 425 | 3·74 | 530 | 11 0 10 | 14 | M | May 30 |
| | 18 | 453 | 3·41 | 515 | 10 14 7 | 4 | M | April 22 |
| | 29 | 399 | 3·79 | 504 | 10 10 0 | 12 | S | May 22 |
| | 26 | 392 | 3·84 | 502 | 10 9 2 | 3 | M | " 20 |
| | 10 | 433 | 3 46 | 500 | 10 8 4 | 14 | S | Dec. 1 |
| Average of . | 8 | 439 | 3·59 | 526 | 10 19 2 | 7·4 | | |
| 8 cows=32 % of the herd. | 13 | 456 | 3·23 | 491 | 10 4 7 | 8 | L | April 26 |
| | 12 | 351 | 4·07 | 477 | 9 18 9 | 3 | M | March 7 |
| | 19 | 356 | 3·88 | 461 | 9 12 1 | 4 | L | Feb. 2 |
| | 3 | 320 | 4·22 | 458 | 9 10 10 | 3 | S | Dec 16 |
| | 2 | 383 | 3 44 | 440 | 9 3 4 | 3 | M | April 2 |
| | 28 | 301 | 4·25 | 427 | 8 17 11 | 2 | L | May 12 |
| | 21 | 251 | 4 69 | 392 | 8 3 4 | 5 | M | Dec. 20* |
| | 11 | 244 | 4·68 | 380 | 7 18 4 | 3 | M | Nov. 13* |
| Average of . | 8 | 333 | 3·97 | 411 | 9 3 9 | 4 | | |
| Average of the whole herd . | 25 | | | | 11 7 4 | 6 1 | | |

## FARM B.

| | No. of cow | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 5d. per gall. £ s. d. | Age of cow. | Size of cow | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 26 cows=66·6 % of the herd. | 36 | 841 | 3·87 | 1086 | 22 12 6 | 8 | L | April 20 |
| | 23 | 784 | 3·64 | 952 | 19 16 8 | 4 | L | " 14 |
| | 6 | 740 | 3·55 | 876 | 18 5 0 | 4 | L | March 20 |
| | 33 | 793 | 3·26 | 862 | 17 19 2 | 10 | M | " 10 |
| | 16 | 690 | 3·55 | 818 | 17 0 10 | 6 | M | " 15 |
| | 9 | 681 | 3·57 | 811 | 16 17 11 | 7 | M | " 18 |
| | 22 | 615 | 3·72 | 764 | 15 18 4 | 7 | M | " 22 |
| | 26 | 649 | 3·50 | 759 | 15 16 3 | 4 | M | " 18 |
| | 29 | 664 | 3·34 | 739 | 15 7 11 | 4 | M | May 3 |
| | 1 | 679 | 3·23 | 732 | 15 5 0 | 8 | M | March 20 |
| | 8 | 582 | 3·77 | 732 | 15 5 0 | 6 | L | " 20† |
| | 3 | 624 | 3·48 | 726 | 15 2 6 | 8 | L | May 21 |
| | 30 | 578 | 3·73 | 718 | 14 19 2 | 3 | S | April 1 |

* Dry, September 20. † Injured.

## Farm B—*continued.*

| | No. of cow. | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 5d. per gall (£ s. d.) | Age of cow. | Size of cow. | Date of last calving |
|---|---|---|---|---|---|---|---|---|
| | 32 | 605 | 3·55 | 717 | 14 18 9 | 5 | M | March 28 |
| | 27 | 602 | 3·52 | 707 | 14 14 7 | 4 | L | " 22 |
| | 15 | 554 | 3·78 | 699 | 14 11 3 | 4 | L | April 24 |
| | 20 | 520 | 3·97 | 689 | 14 7 11 | 6 | M | Feb. 24 |
| | 35 | 664 | 3·08 | 683 | 14 4 7 | 6 | L | April 1 |
| | 10 | 606 | 3 35 | 677 | 14 2 1 | 3 | L | " 14 |
| | 7 | 574 | 3·46 | 662 | 13 15 10 | 6 | M | March 19 |
| | 39 | 544 | 3 50 | 635 | 13 4 7 | 4 | L | " 31 |
| | 34 | 549 | 3·41 | 626 | 13 0 10 | 8 | M | Unknown |
| | 24 | 525 | 3·51 | 616 | 12 16 8 | 6 | M | March 1 |
| | 14 | 606 | 3·04 | 616 | 12 16 8 | 3 | L | " 30 |
| | 2 | 547 | 3·36 | 613 | 12 15 3 | 3 | M | " 7 |
| | 18 | 596 | 3·05 | 606 | 12 12 6 | 13 | S | May 29 |
| Average of . | 26 | 631·2 | 3·49 | 735·4 | 15 6 5 | 5·8 | | ... |
| 10 cows=25·7 % of the herd. | 19 | 511 | 3·50 | 598 | 12 9 2 | 3 | L | April 18 |
| | 25 | 623 | 2·88 | 598 | 12 9 2 | 10 | S | May 21 |
| | 4 | 499 | 3 59 | 596 | 12 8 4 | 2 | M | " 8 |
| | 31 | 608 | 2·92 | 593 | 12 7 1 | 10 | M | Oct. 1 |
| | 13 | 496 | 3 50 | 579 | 12 1 3 | 9 | S | March 4 |
| | 12 | 422 | 4·00 | 563 | 11 14 7 | 2 | M | April 28 |
| | 21 | 528 | 3·18 | 561 | 11 13 9 | 3 | L | " 8 |
| | 28 | 467 | 3·60 | 561 | 11 13 9 | 3 | M | March 5 |
| | 5 | 520 | 3·22 | 559 | 11 12 11 | 13 | S | May 31 |
| | 38 | 423 | 3·84 | 542 | 11 5 10 | 2 | M | April 21 |
| Average of . | 10 | 509·7 | 3 38 | 575 | 11 19 7 | 5 7 | | |
| 3 cows=7·7 % of the herd. | 37 | 481 | 3 05 | 493 | 10 5 7 | 8 | L | March 23 |
| | 11 | 462 | 3·15 | 486 | 10 2 6 | 2 | M | May 6 |
| | 17 | 388 | 3·63 | 470 | 9 15 10 | 2 | L | " 12 |
| Average of . | 3 | 441 7 | 3·26 | 483 | 10 1 3 | 4 | ... | |
| Average of the whole herd . | 39 | | | | 13 16 0 | 5·6 | | |

## FARM C

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 cows=38·8 % of the herd. | 13 | 638 | 3 57 | 760 | 15 16 8 | 8 | L | April 17 |
| | 21 | 566 | 3·86 | 728 | 15 3 4 | 7 | L | March 1 |
| | 38 | 565 | 3·68 | 694 | 14 19 2 | 9 | L | April 30 |
| | 40 | 528 | 3 92 | 692 | 14 18 4 | 8 | L | " 10 |
| | 1 | 533 | 3·85 | 685 | 14 5 3 | 5 | L | " 2 |
| | 35 | 528 | 3 79 | 668 | 13 18 4 | 7 | M | May 2 |
| | 36 | 548 | 3·59 | 657 | 13 13 9 | 7 | S | April 3 |
| | 7 | 534 | 3·69 | 654 | 13 12 6 | 5 | L | March 1 |
| | 30 | 549 | 3·51 | 644 | 13 8 4 | 3 | S | April 1 |
| | 37 | 554 | 3·43 | 634 | 13 4 2 | 8 | L | June 10 |
| | 26 | 607 | 3 07 | 622 | 12 19 2 | 4 | L | March 27 |
| | 39 | 553 | 3 36 | 620 | 12 18 4 | 8 | L | April 18 |
| | 27 | 511 | 3 60 | 614 | 12 15 10 | 6 | S | " 1 |
| | 28 | 524 | 3·46 | 606 | 12 12 6 | 6 | L | March 10 |
| Average of . | 14 | 553 | 3·60 | 663 | 13 16 3 | 6 5 | | |

## FARM C—*continued.*

| | No. of cow. | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 5d. per gall. £ s. d. | Age of cow. | Size of cow. | * Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 12 cows=33·4 % of the herd. | 25 | 531 | 3·38 | 599 | 12 9 7 | 4 | L | June 1 |
| | 18 | 437 | 4·00 | 583 | 12 2 11 | 3 | . | April 10 |
| | 11 | 511 | 3·38 | 576 | 12 0 0 | 8 | M | June 3 |
| | 9 | 555 | 3·07 | 568 | 11 16 8 | 6 | S | March 12 |
| | 24 | 491 | 3·38 | 554 | 11 10 10 | 7 | M | May 1 |
| | 14 | 501 | 3·28 | 549 | 11 8 9 | 6 | L | " 10 |
| | 2 | 489 | 3·33 | 546 | 11 7 6 | 5 | M | April 5 |
| | 16 | 451 | 3·58 | 538 | 11 4 2 | 3 | S | May 4 |
| | 31 | 451 | 3·55 | 534 | 11 2 6 | 3 | S | " 12 |
| | 8 | 472 | 3·32 | 529 | 11 0 5 | 5 | M | Feb. 1 |
| | 34 | 512 | 3·00 | 513 | 10 13 9 | 4 | L | May 10 |
| | 12 | 431 | 3 55 | 511 | 10 12 11 | 7 | M | June 3 |
| Average of . | 12 | 486 | 3·39 | 550 | 11 9 2 | 5 1 | . | . |
| 10 cows=37·8 % of the herd. | 5 | 468 | 3·20 | 499 | 10 7 11 | 6 | S | April 1 |
| | 32 | 393 | 3·64 | 478 | 9 19 2 | 3 | S | " 3 |
| | 23 | 390 | 3·63 | 472 | 9 16 8 | 7 | L | June 14 |
| | 15 | 388 | 3·52 | 457 | 9 10 5 | 3 | S | April 10 |
| | 29 | 337 | 3 43 | 386 | 8 0 10 | 3 | M | March |
| | 33 | 299 | 3·83 | 382 | 7 19 2 | 4 | L | * |
| | 22 | 353 | 3 20 | 377 | 7 17 1 | 2 | M | June 10 |
| | 3 | 340 | 3 16 | 359 | 7 9 7 | 3 | M | Dec. 16† |
| | 4 | 243 | 4·10 | 333 | 6 18 9 | 3 | L | Feb. 12† |
| - | 6 | 289 | 3·41 | 329 | 6 17 1 | 6 | S | Jan.† |
| Average of . | 10 | 350 | 3·49 | 407 | 8 9 7 | 4 | | |
| Average of the whole herd . | 36 | | .. | | 11 10 11 | 5·3 | | |

## FARM D.

| | No. of cow. | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 5d. per gall. £ s. d. | Age of cow. | Size of cow. | * Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 22 cows=75·8 % of the herd. | 1 | 799 | 3 63 | 999 | 20 16 3 | 6 | M | March 26 |
| | 17 | 679 | 4·11 | 932 | 19 8 4 | 8 | L | " 1 |
| | 16 | 720 | 3·81 | 916 | 19 1 8 | 7 | L | " 26 |
| | 14 | 702 | 3·87 | 904 | 18 16 8 | 7 | M | April 15 |
| | 12 | 690 | 3 81 | 878 | 18 5 10 | 5 | M | " 1 |
| | 30 | 690 | 3·55 | 817 | 17 0 1 | 8 | S | " 2 |
| | 31 | 651 | 3 73 | 810 | 16 17 6 | 4 | M | " 4 |
| | 22 | 578 | 4 19 | 808 | 16 16 8 | 4 | M | May 12 |
| | 29 | 611 | 3·92 | 798 | 16 12 6 | 9 | M | April 2 |
| | 25 | 580 | 4·00 | 774 | 16 2 6 | 14 | L | March 15 |
| | 19 | 615 | 3·72 | 763 | 15 17 11 | 7 | L | Feb. 12 |
| | 5 | 605 | 3 51 | 709 | 14 15 5 | 5 | M | March 28 |
| | 18 | 503 | 4 13 | 697 | 14 10 5 | 3 | M | Feb. 8 |
| | 13 | 528 | 3·95 | 695 | 14 9 7 | 5 | L | " 15 |
| | 26 | 543 | 3·78 | 684 | 14 5 0 | 3 | L | March 29 |
| | 8 | 508 | 3·99 | 672 | 14 0 0 | 3 | L | April 14 |
| | 27 | 524 | 3·83 | 669 | 13 18 9 | 6 | M | March 13‡ |
| | 21 | 532 | 3 58 | 636 | 13 5 0 | 10 | L | " 30 |
| | 2 | 465 | 4·08 | 633 | 13 3 9 | 3 | L | April 1 |
| | 10 | 479 | 3·90 | 624 | 13 0 0 | 3 | S | June 4 |
| | 28 | 474 | 3·95 | 624 | 13 0 0 | 9 | L | March 15 |
| | 7 | 555 | 3·32 | 615 | 12 16 3 | 4 | S | May 14 |
| Average of . | 22 | 592 3 | 3·83 | 757 | 15 15 5 | 6 | | . |

* Aborted, January † Dry, September 23 ‡ Not served.

FARM D—*continued.*

| | No of cow | Total milk in galls | Average % of fat | Galls milk of 3 % of fat | Value of produce at 5d per gall £ s. d. | Age of cow | Size of cow | Date of last calving |
|---|---|---|---|---|---|---|---|---|
| 5 cows=17 3 % of the herd. | 23 | 497 | 3 61 | 597 | 12 9 9 | 7 | S | March 14* |
| | 3 | 502 | 3·55 | 595 | 12 8 11 | 8 | M | " 14 |
| | 6 | 460 | 3 83 | 588 | 12 5 0 | 7 | S | Jan. 1 |
| | 9 | 479 | 3 50 | 559 | 11 12 11 | 4 | S | March 28 |
| | 24 | 492 | 3 39 | 557 | 11 12 1 | 13 | M | " 25 |
| Average of . | 5 | 486 | 3 57 | 579 | 12 0 5 | 7·8 | | |
| 2 cows=6 9 % of the herd | 11 | 350 | 4 04 | 471 | 9 16 3 | 3 | M | March 28† |
| | 20 | 366 | 3 69 | 452 | 9 8 4 | 3 | L | " 20‡ |
| Average of . | 2 | 358 | 3 87 | 461 | 9 12 1 | 3 | ... | |
| Average of the whole herd . | 29 | | | | 14 7 0 | 6 1 | | |

## FARM E

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 27 cows=75 % of the herd | 10 | 788 | 4·25 | 1117 | 23 5 5 | 6 | L | March 29 |
| | 33 | 767 | 4·02 | 1029 | 21 8 9 | 13 | M | April 23 |
| | 24 | 776 | 3 69 | 955 | 19 7 11 | 7 | L | March 12 |
| | 23 | 629 | 3·81 | 800 | 16 13 4 | 9 | M | " 27 |
| | 34 | 571 | 4·10 | 782 | 16 5 10 | 4 | M | " 25 |
| | 20 | 715 | 3 27 | 781 | 16 5 5 | 9 | M | April 20 |
| | 25 | 642 | 3·61 | 775 | 16 2 11 | 7 | M | March 30 |
| | 11 | 684 | 3 38 | 773 | 16 2 1 | 8 | L | April 7 |
| | 19 | 625 | 3 7 | 771 | 16 1 3 | 11 | L | March 20 |
| | 9 | 594 | 3 76 | 744 | 15 10 0 | 6 | L | " 29 |
| | 32 | 663 | 3 34 | 738 | 15 7 6 | 14 | S | " 5 |
| | 28 | 662 | 3 33 | 735 | 15 6 3 | 9 | M | " 21 |
| | 6 | 638 | 3·39 | 722 | 15 0 10 | 11 | M | " 1 |
| | 14 | 545 | 3·95 | 718 | 14 19 2 | 8 | S | April 29 |
| | 4 | 529 | 4·05 | 716 | 14 18 4 | 6 | L | March 7 |
| | 29 | 527 | 4·05 | 712 | 14 16 8 | 4 | L | " 26 |
| | 12 | 542 | 3·77 | 680 | 14 3 4 | 3 | M | April 5 |
| | 36 | 550 | 3·64 | 667 | 13 17 11 | 4 | M | March 30 |
| | 16 | 508 | 3 90 | 662 | 13 15 10 | 4 | M | April 25 |
| | 8 | 514 | 3·73 | 641 | 13 6 8 | 4 | M | " 23 |
| | 37 | 483 | 3·93 | 634 | 13 4 2 | 3 | M | May 3 |
| | 26 | 566 | 3·35 | 632 | 13 3 4 | 7 | M | Feb. 23 |
| | 38 | 547 | 3·45 | 630 | 13 2 6 | 3 | L | April 7 |
| | 35 | 550 | 3·43 | 629 | 13 2 1 | 4 | S | March 9 |
| | 30 | 493 | 3·80 | 626 | 13 0 10 | 11 | M | " 27 |
| | 22 | 488 | 3·72 | 603 | 12 11 3 | 3 | L | April 9 |
| | 21 | 498 | 3·61 | 600 | 12 10 0 | 6 | L | March 20 |
| Average of . | 27 | 596·1 | 3·70 | 736 | 15 6 8 | 6·8 | | |
| 7 cows=19·4 % of the herd. | 13 | 506 | 3·53 | 596 | 12 8 4 | 11 | M | April 4 |
| | 1 | 509 | 3 50 | 595 | 12 7 11 | 3 | M | " 6 |
| | 7 | 526 | 3·38 | 594 | 12 7 6 | 4 | M | " 4 |
| | 17 | 493 | 3·48 | 572 | 11 18 4 | 3 | M | " 13 |

* Not served. † Dry, November 12. ‡ Dry, October 29.

## FARM E—*continued.*

| | No. of cow | Total milk in galls. | Average % of fat | Galls. milk of 3 % of fat | Value of produce at 5d. per gall | Age of cow. | Size of cow | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| | | | | | £ s. d. | | | |
| | 3 | 516 | 3·19 | 549 | 11 8 9 | 9 | L | Feb. 22 |
| | 5 | 515 | 3·07 | 528 | 11 0 0 | 4 | M | April 2 |
| | 27 | 440 | 3·53 | 519 | 10 16 3 | 7 | M | March 21 |
| Average of . | 7 | 501 | 3·38 | 565 | 11 15 5 | 5·9 | | |
| 2 cows=5·6 % of the herd. | 15 | 361 | 3·85 | 465 | 9 13 9 | 2 | M | April 9 |
| | 2 | 392 | 3·51 | 459 | 9 11 3 | 6 | L | Feb. 22 |
| Average of . | 2 | 376 | 3·68 | 462 | 9 12 6 | 4 | | |
| Average of the whole herd . | 36 | . | | . | 14 6 5 | 6·4 | | ... |

## FARM F.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 40 | 800 | 3·87 | 1033 | 21 10 5 | 7 | L | May 9* |
| | 26 | 631 | 4·00 | 843 | 17 11 3 | 8 | L | April 28 |
| | 3 | 562 | 4·25 | 796 | 16 11 8 | 8 | M | " 7 |
| | 38 | 616 | 3·77 | 775 | 16 2 11 | 7 | | Feb. 22† |
| | 23 | 581 | 3·94 | 763 | 15 17 11 | 5 | S | April 18 |
| | 1 | 550 | 4·09 | 750 | 15 12 6 | 5 | | " 14 |
| | 36 | 582 | 3·73 | 725 | 15 2 1 | 6 | M | " 4 |
| 15 cows=35 % of the herd. | 41 | 546 | 3·85 | 701 | 14 12 1 | 4 | L | May 23 |
| | 37 | 547 | 3·83 | 698 | 14 10 10 | 6 | | April 29 |
| | 4 | 557 | 3·67 | 681 | 14 3 9 | 12 | S | Feb. 29 |
| | 9 | 535 | 3·73 | 667 | 13 17 11 | 8 | M | " 29 |
| | 21 | 461 | 4·13 | 636 | 13 5 0 | 6 | L | " 20 |
| | 28 | 526 | 3·61 | 634 | 13 4 2 | 5 | M | March 28 |
| | 30 | 566 | 3·31 | 625 | 13 0 5 | 5 | M | " 9 |
| | 2 | 495 | 3·73 | 615 | 12 16 3 | 3 | | April 13 |
| Average of . | 15 | 570 | 3·83 | 730 | 15 4 1 | 6·3 | | |
| | 20 | 554 | 3·19 | 590 | 12 5 10 | 6 | S | April 1 |
| | 19 | 446 | 3·95 | 587 | 12 4 7 | 3 | | " 2 |
| | 18 | 502 | 3·49 | 585 | 12 3 9 | 5 | | March 23 |
| | 13 | 582 | 2·99 | 581 | 12 2 1 | 6 | M | April 19 |
| | 14 | 463 | 3·75 | 579 | 12 1 3 | 4 | M | March 21 |
| | 6 | 574 | 3·52 | 574 | 11 19 2 | 5 | | April 15 |
| | 25 | 478 | 3·60 | 574 | 11 19 2 | 5 | M | March 6 |
| 16 cows=40 % of the herd. | 22 | 510 | 3·36 | 571 | 11 17 11 | 4 | M | Feb. 15 |
| | 34 | 495 | 3·44 | 568 | 11 16 8 | 5 | M | April 24† |
| | 39 | 496 | 3·43 | 565 | 11 15 5 | 4 | | " 27 |
| | 16 | 496 | 3·28 | 544 | 11 6 8 | 5 | S | March 2 |
| | 7 | 465 | 3·46 | 537 | 11 3 9 | 5 | M | " 3 |
| | 21 | 443 | 3·59 | 530 | 11 0 10 | 8 | | " 3 |
| | 31 | 380 | 4·10 | 520 | 10 16 8 | 3 | | April 19 |
| | 12 | 451 | 3·45 | 519 | 10 16 3 | 5 | S | " 14 |
| | 32 | 383 | 4·01 | 513 | 10 13 9 | 3 | | " 16 |
| Average of . | 16 | 482 | 3·47 | 558·5 | 11 12 6 | 4·8 | . | . |

* Only for 28 weeks. † Not tested at first visit.

## Farm F—*continued.*

| | No. of cow | Total milk in galls | Average % of fat | Galls. milk of 3 % of fat | Value of produce at 5d per gall £ s d. | Age of cow | Size of cow | Date of last calving |
|---|---|---|---|---|---|---|---|---|
| 10 cows=25 % of the herd. | 5 | 453 | 3·29 | 498 | 10 7 6 | 3 | | April 17 |
| | 35 | 426 | 3·38 | 480 | 10 0 0 | 4 | M | March 20 |
| | 11 | 399 | 3·60 | 479 | 9 19 7 | 3 | | April 10 |
| | 8 | 452 | 3·15 | 476 | 9 18 4 | 7 | L | Feb 17 |
| | 17 | 411 | 3·35 | 459 | 9 11 3 | 7 | M | March 26 |
| | 33 | 397 | 3·35 | 444 | 9 5 0 | 5 | ... | April 3 |
| | 10 | 332 | 3·91 | 434 | 9 0 10 | 3 | | " 26 |
| | 15 | 356 | 3·57 | 425 | 8 17 1 | 3 | | March 19 |
| | 29 | 384 | 3·05 | 391 | 8 2 11 | 6 | M | " 15 |
| | 27 | 329 | 3·55 | 390 | 8 2 6 | 3 | | April 16 |
| Average of . | 10 | 393·9 | 3·41 | 447·6 | 9 6 6 | 4·4 | | |
| Average of the whole herd . | 41 | | | | 12 6 3 | 5·2 | | |

## FARM G.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 12 cows=33·3 % of the herd. | 29 | 583 | 4·10 | 797 | 16 12 1 | 5 | M | April 10 |
| | 10 | 605 | 3·66 | 738 | 15 7 6 | 5 | M | March 30 |
| | 27 | 633 | 3·46 | 731 | 15 4 7 | 9 | M | " 4 |
| | 14 | 650 | 3·31 | 719 | 14 19 7 | 7 | L | April 10 |
| | 25 | 519 | 4·09 | 708 | 14 15 0 | 6 | M | " 30 |
| | 16 | 529 | 3·94 | 695 | 14 9 7 | 6 | S | " 1 |
| | 18 | 567 | 3·65 | 690 | 14 7 6 | 8 | M | March 10 |
| | 12 | 513 | 3·91 | 670 | 13 19 2 | 4 | M | " 24 |
| | 19 | 550 | 3·43 | 630 | 13 2 6 | 10 | M | Feb. 28 |
| | 32 | 511 | 3·69 | 629 | 13 2 1 | 6 | M | April 3 |
| | 5 | 548 | 3·43 | 627 | 13 1 3 | 5 | L | March 20 |
| | 13 | 486 | 3·73 | 605 | 12 12 1 | 4 | L | " 12 |
| Average of . | 12 | 558 | 3·70 | 686·6 | 14 6 1 | 6·2 | | |
| 17 cows=47·2 % of the herd. | 11 | 496 | 3·62 | 598 | 12 9 2 | 5 | M | Feb. 27 |
| | 1 | 541 | 3·31 | 597 | 12 8 9 | 7 | M | March 10 |
| | 7 | 533 | 3·28 | 583 | 12 3 11 | 10 | L | April 10 |
| | 8 | 501 | 3·48 | 582 | 12 3 6 | 8 | L | March |
| | 21 | 411 | 4·12 | 565 | 11 15 5 | 3 | S | Feb. 1* |
| | 24 | 507 | 3·32 | 562 | 11 14 2 | 6 | M | March 2 |
| | 3 | 453 | 3·71 | 560 | 11 13 4 | 3 | M | Feb. |
| | 6 | 542 | 3·08 | 558 | 11 12 6 | 5 | L | April 10 |
| | 37 | 484 | 3·44 | 556 | 11 11 8 | 3 | S | " 5 |
| | 28 | 411 | 3·91 | 537 | 11 3 9 | 7 | M | Feb. 26 |
| | 31 | 464 | 3·32 | 536 | 11 3 4 | 6 | S | March 30 |
| | 26 | 482 | 3·30 | 531 | 11 1 3 | 5 | S | " 25* |
| | 22 | 429 | 3·67 | 525 | 10 18 9 | 3 | S | Oct.† |
| | 4 | 445 | 3·49 | 518 | 10 15 10 | 6 | S | Feb. 17 |
| | 33 | 422 | 3·68 | 518 | 10 15 10 | 2 | M | April 25 |
| | 2 | 461 | 3·34 | 515 | 10 14 7 | 6 | L | " 20 |
| | 36 | 390 | 3·87 | 504 | 10 10 0 | 3 | M | March 19 |
| Average of . | 17 | 469 | 3·51 | 549·7 | 11 9 0 | 5·2 | | ... |

* Dry, October 26 † Dry, October 12.

## Farm G—*continued.*

| | No. of cow | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 6d. per gall £ s. d. | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 7 cows=19·5 % of the herd. | 15 | 464 | 3·18 | 493 | 10 5 5 | 3 | S | April 1* |
| | 38 | 454 | 3·18 | 482 | 10 0 10 | 3 | S | " 20 |
| | 30 | 404 | 3·57 | 481 | 10 0 5 | 4 | M | " 15 |
| | 20 | 329 | 3·99 | 438 | 9 2 6 | 3 | S | Jan. 1† |
| | 17 | 391 | 3 21 | 419 | 8 14 7 | 3 | S | Feb. 12* |
| | 34 | 334 | 3·60 | 401 | 8 7 1 | 2 | S | April 30 |
| | 35 | 343 | 3·31 | 379 | 7 17 11 | 3 | S | Nov. |
| Average of . | 7 | 388 | 3 42 | 142 | 9 4 2 | 3 | . | ... |
| Average of the whole herd . | 36 | | | | 12 0 1 | 5·1 | | ... |

## FARM H.

| | No. of cow | Total milk in galls. | Average % of fat. | Galls. milk of 3 % of fat. | Value of produce at 6d. per gall £ s. d. | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 8 cows=38·1 % of the herd. | 32 | 492 | 4·09 | 672 | 14 0 0 | 3 | L | April 21 |
| | 22 | 496 | 3·93 | 650 | 13 10 10 | 6 | M | " 2 |
| | 38 | 506 | 3 80 | 642 | 13 7 6 | 9 | M | " 15 |
| | 1 | 507 | 3 78 | 640 | 13 6 8 | 6 | S | " 10 |
| | 5 | 549 | 3·47 | 636 | 13 5 0 | 5 | M | " 1 |
| | 31 | 497 | 3·71 | 616 | 12 16 8 | 3 | L | " 28 |
| | 23 | 513 | 3·59 | 616 | 12 16 8 | 7 | L | " 14 |
| | 4 | 549 | 3·33 | 611 | 12 14 7 | 7 | L | May 1 |
| Average of . | 8 | 513·6 | 3·71 | 635 4 | 13 14 9 | 5·75 | . | . |
| 6 cows=28·6 % of the herd. | 9 | 496 | 3 49 | 577 | 12 0 5 | 8 | L | April 15 |
| | 24 | 506 | 3·37 | 568 | 11 16 8 | 6 | M | March 17 |
| | 14 | 398 | 4·27 | 566 | 11 15 10 | 6 | L | April 1 |
| | 27 | 411 | 3 85 | 529 | 11 0 5 | 3 | M | " 25 |
| | 8 | 423 | 3·74 | 529 | 11 0 5 | 3 | M | June 1 |
| | 6 | 434 | 3·63 | 525 | 10 18 9 | 5 | S | April 30 |
| Average of . | 6 | 444·7 | 3·70 | 549 | 11 8 9 | 5·2 | | ... |
| 7 cows=33·3 % of the herd. | 28 | 365 | 3·94 | 480 | 10 0 ·0 | 3 | M | April 17 |
| | 26 | 404 | 3·54 | 478 | 9 19 2 | 6 | M | " 5 |
| | 40 | 413 | 3·39 | 467 | 9 14 7 | 9 | L | Jan. 1 |
| | 3 | 432 | 3·23 | 466 | 9 14 2 | 11 | L | March 6 |
| | 33 | 421 | 3·22 | 453 | 9 8 9 | 10 | L | " 1 |
| | 36 | 380 | 3·45 | 438 | 9 2 6 | 6 | M | Feb. |
| | 7 | 389 | 3 32 | 431 | 8 19 7 | 5 | L | May 15 |
| Average of . | 7 | 400·6 | 3·43 | 459 | 9 11 3 | 7·1 | .. | .. |
| Average of the whole herd . | 21 | | | | 11 12 9 | 6 0 | ... | ... |

* Dry, October 26. † Dry, October 12.

## FARM I.

| | No. of cow. | Total milk in galls | Average % of fat. | Galls milk of 3 % of fat | Value of produce at 5d per gall £ s. d. | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| 12 cows=36·4 % of the herd. | 5 | 642 | 4·05 | 868 | 18 1 8 | 10 | M | March 20 |
| | 30 | 700 | 3·41 | 796 | 16 11 8 | 8 | M | " 20 |
| | 31 | 624 | 3·72 | 775 | 16 2 11 | 8 | L | May 28 |
| | 3 | 693 | 3·28 | 759 | 15 16 3 | 8 | M | April 28 |
| | 33 | 644 | 3·50 | 751 | 15 12 11 | 10 | L | March 8 |
| | 8 | 577 | 3·83 | 736 | 15 6 8 | 8 | S | " 10 |
| | 4 | 672 | 3·35 | 731 | 15 4 7 | 10 | M | " 4 |
| | 15 | 581 | 3·77 | 730 | 15 4 2 | 8 | M | " 6 |
| | 32 | 574 | 3 78 | 724 | 15 1 8 | 10 | L | " 10 |
| | 6 | 495 | 4 29 | 708 | 14 15 0 | 5 | L | " 20 |
| | 20 | 553 | 3·43 | 632 | 13 3 4 | 7 | L | " 3 |
| | 29 | 437 | 4·19 | 612 | 12 15 0 | 6 | M | April 1 |
| Average of . | 12 | 599 | 3 67 | 735 | 15 6 3 | 8·2 | | |
| 8 cows=21·2 % of the herd. | 12 | 443 | 3 92 | 580 | 12 1 8 | 3 | L | Feb. 5 |
| | 26 | 492 | 3·51 | 576 | 12 0 0 | 6 | L | March 10 |
| | 35 | 455 | 3·78 | 573 | 11 18 9 | 5 | M | " 24 |
| | 7 | 513 | 3·10 | 530 | 11 0 10 | 8 | M | " 2 |
| | 16 | 425 | 3 71 | 527 | 10 19 7 | 8 | S | " 10 |
| | 1 | 360 | 4 38 | 526 | 10 19 2 | 3 | L | Feb 10 |
| | 28 | 424 | 3·60 | 509 | 10 12 1 | 6 | S | Dec 24 |
| | 17 | 372 | 4·04 | 502 | 10 9 2 | 3 | M | May 12 |
| Average of . | 8 | 435 5 | 3·72 | 510 | 11 5 0 | 5·25 | | .. |
| 13 cows=39 1 % of the herd. | 10 | 483 | 3 09 | 499 | 10 7 11 | 4 | S | April 29 |
| | 27 | 384 | 3 84 | 496 | 10 6 8 | 6 | L | March 12 |
| | 18 | 310 | 4 11 | 426 | 8 17 6 | 4 | S | Jan. 20 |
| | 23 | 313 | 4·03 | 420 | 8 15 0 | 3 | L | Feb. 26 |
| | 21 | 342 | 3·65 | 417 | 8 13 9 | 4 | S | " 29 |
| | 2 | 320 | 3·79 | 405 | 8 8 9 | 3 | L | " 21 |
| | 25 | 385 | 4·23 | 403 | 8 7 11 | 6 | L | Dec. 25 |
| | 13 | 299 | 3·92 | 390 | 8 2 6 | 2 | S | May 1* |
| | 19 | 307 | 3·68 | 376 | 7 16 8 | 8 | S | " 8 |
| | 9 | 301 | 3·73 | 376 | 7 16 8 | 4 | M | Jan. 4 |
| | 11 | 321 | 3·46 | 371 | 7 14 7 | 3 | L | Feb. 4 |
| | 24 | 336 | 3·23 | 362 | 7 10 10 | 3 | S | March 3 |
| | 14 | 349 | 2 94 | 341 | 7 2 1 | 4 | L | Feb. 25† |
| Average of . | 13 | 318 | 3·83 | 406 | 8 9 2 | 4·2 | | |
| Average of the whole herd . | 33 | | ... | | 11 12 6 | 5 9 | | ... |

## FARM J.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 cows=8 % of the herd. | 24 | 540 | 3·61 | 651 | 13 11 3 | 8 | M | Feb. 20 |
| | 25 | 544 | 3·52 | 638 | 13 5 10 | 8 | L | April 4 |
| Average of . | 2 | 542 | 3 56 | 645 | 13 8 9 | 8 | | . |

* Dry after October 22. † Dry, October 22.

FARM J—*continued.*

| | No. of cow | Total milk in galls | Average % of fat | Galls milk of 3 % of fat. | Value of produce at 5d. per gall | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| | | | | | £ s. d. | | | |
| 6 cows=24 % of the herd. | 10 | 467 | 3·82 | 594 | 12 7 6 | 10 | M | March 1 |
| | 3 | 515 | 3·28 | 565 | 11 15 5 | 4 | M | " 12 |
| | 20 | 479 | 3·51 | 560 | 11 13 4 | 7 | S | " 1 |
| | 10 | 427 | 3·89 | 554 | 11 10 10 | 7 | M | " 1 |
| | 22 | 479 | 3·43 | 548 | 11 8 4 | 7 | M | " 10 |
| | 13 | 497 | 3·27 | 542 | 11 5 10 | 5 | M | April 2 |
| | 23 | 413 | 3 89 | 535 | 11 2 11 | 3 | L | March 25 |
| Average of . | 6 | 468 | 3·53 | 550·7 | 11 9 7 | 5 5 | | . . |
| 17 cows=68 % of the herd. | 21 | 430 | 3·47 | 498 | 10 7 6 | 6 | M | Feb. 26 |
| | 7 | 394 | 3·71 | 487 | 10 2 11 | 4 | M | March 20 |
| | 16 | 396 | 3 65 | 483 | 10 0 3 | 3 | S | April 18 |
| | 8 | 402 | 3·59 | 482 | 9 19 10 | 4 | M | March 20 |
| | 18 | 423 | 3·41 | 481 | 9 19 5 | 3 | S | April 12 |
| | 9 | 446 | 3 20 | 476 | 9 18 4 | 5 | M | " 1 |
| | 11 | 362 | 3·94 | 475 | 9 17 11 | 4 | S | " 16 |
| | 2 | 414 | 3·21 | 444 | 9 5 0 | 4 | L | March 21 |
| | 15 | 383 | 3·45 | 441 | 9 3 9 | 3 | L | April 24 |
| | 14 | 397 | 3 32 | 439 | 9 2 11 | 5 | M | " 3 |
| | 5 | 418 | 3·14 | 438 | 9 2 6 | 5 | S | March 9 |
| | 12 | 450 | 2·90 | 436 | 9 1 8 | 4 | M | April 26 |
| | 17 | 346 | 3·73 | 431 | 8 19 7 | 3 | M | " 26 |
| | 1 | 394 | 3 09 | 402 | 8 7 6 | 4 | L | " 14 |
| | 19 | 295 | 3·95 | 389 | 8 2 1 | 2 | S | " 9 |
| | 4 | 380 | 2·92 | 370 | 7 14 2 | 4 | M | March 25 |
| | 6 | 297 | 3·26 | 323 | 6 14 7 | 4 | M | May 12* |
| Average of . | 17 | 390 | 3·39 | 441 | 9 3 9 | 4 | | |
| Average of the whole herd . | 25 | | | 465 6 | 9 14 0 | 4 8 | | |

## FARM K.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15 cows=44·1 % of the herd. | 11 | 644 | 4 11 | 883 | 18 7 11 | 7 | M | Unknown |
| | 37 | 636 | 4 00 | 848 | 17 13 4 | 9 | L | " |
| | 33 | 582 | 4·22 | 820 | 17 1 8 | 5 | L | " |
| | 8 | 643 | 3·82 | 819 | 17 1 3 | 4 | L | " |
| | 12 | 677 | 3 54 | 800 | 16 13 4 | 8 | L | " |
| | 29 | 649 | 3·69 | 798 | 16 12 6 | 8 | L | " |
| | 18 | 670 | 3·37 | 753 | 15 13 9 | 6 | L | " |
| | 17 | 585 | 3 68 | 719 | 14 19 7 | 3 | M | May 1 |
| | 2 | 543 | 3 79 | 687 | 14 6 3 | 5 | M | Unknown |
| | 27 | 509 | 3·96 | 673 | 14 0 5 | 4 | M | " |
| | 5 | 525 | 3 63 | 636 | 13 5 0 | 7 | L | " |
| | 14 | 504 | 3 74 | 629 | 13 2 1 | 3 | L | May 1 |
| | 3 | 482 | 3·88 | 625 | 13 0 5 | 4 | M | Unknown |
| | 13 | 518 | 3·57 | 616 | 12 16 8 | 8 | L | " |
| | 31 | 421 | 4·35 | 611 | 12 14 7 | 2 | S | " |
| Average of . | 15 | 572 5 | 3·81 | 727·8 | 15 3 2 | 5·8 | | |

* Dry, October 24.

## Farm K—*continued.*

| | No. of cow. | Total milk in galls | Average % of fat | Galls. milk of 3 % of fat | Value of produce at 5d per gall | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| | | | | | £ s d. | | | |
| | 15 | 435 | 4·12 | 597 | 12 8 9 | 6 | L | Unknown |
| | 21 | 470 | 3·55 | 558 | 11 12 6 | 4 | M | " |
| 6 cows=17·7 % of the herd. | 35 | 405 | 4·03 | 544 | 11 6 8 | 5 | M | Dec. 20 |
| | 26 | 393 | 4·07 | 534 | 11 2 6 | 4 | S | May |
| | 38 | 375 | 4·12 | 516 | 10 15 0 | 2 | S | " 1 |
| | 34 | 378 | 3·98 | 503 | 10 9 7 | 2 | S | " 1 |
| Average of . | 6 | 409·3 | 3 97 | 542 | 11 5 10 | 4·0 | | .. |
| | 9 | 339 | 4 22 | 477 | 9 18 9 | 2 | L | April 21 |
| | 6 | 368 | 3·78 | 464 | 9 13 0 | 3 | M | Unknown |
| | 23 | 412 | 3·37 | 463 | 9 12 7 | 4 | M | " |
| | 30 | 276 | 4·92 | 453 | 9 8 9 | 2 | S | . * |
| | 22 | 365 | 3·69 | 449 | 9 7 1 | 4 | M | April 28 |
| | 7 | 340 | 3·78 | 430 | 8 19 2 | 2 | M | Unknown |
| 13 cows=38·2 % of the herd. | 39 | 293 | 4·31 | 421 | 8 15 5 | 2 | S | " † |
| | 1 | 374 | 3·22 | 401 | 8 7 1 | 7 | L | ‡ |
| | 25 | 251 | 4·43 | 371 | 7 14 7 | 4 | M | Unknown |
| | 4 | 374 | 3·99 | 365 | 7 12 1 | 2 | L | May 16 |
| | 36 | 261 | 4·09 | 356 | 7 8 4 | 5 | M | Unknown |
| | 19 | 318 | 3·36 | 356 | 7 8 4 | 3 | L | May 1† |
| | 40 | 170 | 4 10 | 233 | 4 4 7 | 6 | M | Unknown |
| Average of . | 13 | 318 5 | 3·79 | 403 | 8 7 11 | 4 | . | |
| Average of the whole herd . | 34 | | | | 11 17 9 | 5·3 | ... | |

## FARM L.

| | No. of cow. | Total milk in galls | Average % of fat | Galls. milk of 3 % of fat | Value of produce at 5d per gall | Age of cow. | Size of cow. | Date of last calving. |
|---|---|---|---|---|---|---|---|---|
| | 23 | 558 | 4·54 | 846 | 17 12 6 | 8 | S | April 18 |
| | 26 | 689 | 3 68 | 845 | 17 12 1 | 8 | M | " 2 |
| | 16 | 719 | 3·39 | 815 | 16 19 7 | 8 | M | March 11 |
| | 20 | 671 | 3·56 | 797 | 16 12 1 | 7 | L | May 3 |
| | 10 | 653 | 3·49 | 761 | 15 17 1 | 5 | S | March 1 |
| | 9 | 487 | 4 43 | 720 | 15 0 0 | 10 | M | " 1 |
| | 15 | 560 | 3·85 | 720 | 15 0 0 | 5 | M | Feb. 13 |
| | 25 | 574 | 3·60 | 690 | 14 7 6 | 4 | L | March 19 |
| | 11 | 564 | 3·66 | 688 | 14 6 8 | 9 | M | " 3 |
| 19 cows=54 3 % of the herd. | 31 | 662 | 3 12 | 688 | 14 6 8 | 6 | S | Feb. 26 |
| | 36 | 560 | 3·67 | 685 | 14 5 5 | 8 | S | March 22 |
| | 29 | 581 | 3 53 | 685 | 14 5 5 | 6 | M | May 6 |
| | 33 | 559 | 3·42 | 638 | 13 5 10 | 8 | S | Feb. 28 |
| | 5 | 573 | 3 27 | 626 | 13 0 10 | 9 | S | March 15 |
| | 28 | 580 | 3·22 | 623 | 12 19 7 | 10 | L | Feb. 29 |
| | 35 | 574 | 3·23 | 618 | 12 17 6 | 6 | M | Jan. 13 |
| | 2 | 504 | 3·59 | 604 | 12 11 8 | 3 | . | Dec. 16 |
| | 13 | 512 | 3 52 | 602 | 12 10 10 | 7 | . | May 7 |
| | 21 | 444 | 4·06 | 600 | 12 10 0 | 3 | M | Feb. 21 |
| Average of . | 19 | 580 | 3·61 | 697·4 | 14 10 7 | 6·8 | . | . |

Not served. † Dry after October 6. ‡ Aborted, April 21.

FARM L—*continued.*

| | No of cow | Total milk in galls | Average % of fat | Galls milk of 3 % of fat | Value of produce at 5d per gall. | Age of cow. | Size of cow. | Date of last calving |
|---|---|---|---|---|---|---|---|---|
| | | | | | £ s. d. | | | |
| | 34 | 450 | 3·92 | 588 | 12 5 0 | 4 | S | Feb. 11 |
| | 3 | 477 | 3·69 | 587 | 12 4 7 | 6 | ... | March 11 |
| | 19 | 449 | 3 90 | 584 | 12 3 4 | 4 | L | Jan. 21 |
| 8 cows—22 85 % | 38 | 513 | 3·33 | 570 | 11 17 6 | 5 | L | Feb. 6 |
| of the herd. | 4 | 512 | 3·32 | 566 | 11 15 10 | 7 | M | March 10 |
| | 32 | 362 | 4·55 | 550 | 11 9 2 | 3 | M | Nov 29 |
| | 6 | 318 | 4·98 | 529 | 11 0 5 | 3 | . . | Jan. 17 |
| | 40 | 345 | 4·39 | 505 | 10 10 5 | 3 | M | Dec. 10 |
| Average of . | 8 | 428·5 | 3 92 | 559·9 | 11 13 3 | 4·3 | | ... |
| | 14 | 384 | 3·76 | 481 | 10 0 5 | 3 | M | Nov. 30 |
| | 8 | 386 | 3·62 | 466 | 9 14 2 | 7 | L | Feb. 15 |
| | 12 | 427 | 3·23 | 461 | 9 12 1 | 11 | L | March 5 |
| 8 cows=22·85 % | 21 | 380 | 3·59 | 455 | 9 9 7 | 4 | L | Feb. 7 |
| of the herd. | 30 | 353 | 3 75 | 442 | 9 4 2 | 4 | L | Jan. 25 |
| | 18 | 303 | 4·19 | 424 | 8 16 8 | 6 | M | Dec. 19 |
| | 27 | 331 | 3·12 | 344 | 7 3 4 | 6 | L | " 7 |
| | 1 | 240 | 3 28 | 263 | 5 9 7 | 7 | | " 5 |
| Average of . | 8 | 350·5 | 3·57 | 417 | 8 13 9 | 6 | | . |
| Average of the whole herd . | 35 | | | | 12 10 9 | 6·0 | | . . |

# ON SOME INJURIOUS INSECTS OF 1904.

By Dr R. STEWART MACDOUGALL, M.A., Consulting Entomologist to the Society.

## THE BLACK CURRANT GALL-MITE—*Eriophyes* (*Phytoptus*) *ribis.*

NEVER a year passes without complaints being made of this mite, and specimens of attacked and dead buds being received. The mite belongs to the Eriophyidæ, a family of most minute mites, many of them considerably less than the one-hundredth part of an inch in length. The species are numerous, and they give rise to galls or misshapen growths on leaves, twigs, fruits, and buds, of trees and smaller plants.

The Gall-Mite of the Black Currant, known now as Eriophyes rather than Phytoptus, has an elongated worm-like body, the abdomen of which has a series of rings or transverse striations. At the front end are four short legs, each ending in a bristle,

known as the "feather hair." Besides these four legs the mite has three pairs of bristles projecting from the side of the body, two of the pairs on the front half and a pair of shorter bristles near the hind end. From the tail-end project two long bristles which are capable of service to the mite in locomotion. At the end of the abdomen there is also a muscular sucker by which the mite can erect and support itself. These gall-mites of the black currant are too small to be seen by the naked eye, but if the swollen buds be dissected or teased out and examined with the microscope, many of the mites can be seen. The buds chosen for this examination should not be dried and withered ones, but abnormally swollen buds that have not been quite destroyed. In buds on twigs sent to me in December, January, and February, I found numbers of the mites at work.

Infested buds swell, and they may die away without developing, or produce stunted poor shoots, or give fair shoots, according to the number of the pests present in the buds. Since I last referred to *Eriophyes ribis* in the 'Transactions' of 1899, very interesting facts have been brought to light as regards points in the life-history previously obscure. We owe these to Cecil Warburton, Esq., M.A., F.L.S., and Miss Alice Embleton, B.Sc., the results of their joint work on *E. ribis* being communicated to the Journal of the Linnæan Society, April 1, 1902.

*The Year's Life of the Mite.*

The mites shelter in the infested buds during the winter, and in spring may begin to migrate, if the buds in which they have been sheltering are too badly attacked to admit of some development. The leaves of such buds having expanded somewhat, these mites, deprived of their shelter-places, must migrate. This migration may be termed a chance-migration, and probably most of these mites die. The real migration for the year takes place from destroyed unexpanded buds from the middle of April onwards according to the season, increasing in intensity, to spend itself by the middle of June. These migratory mites are adult, and the females proceed to egg-laying in the new buds that have been reached. Young forms hatch from the eggs, and on through July and August the numbers of the mites increase in the buds, which, as a result, are swollen. Here the pests remain in shelter during the winter, preparatory to the migration and renewal of the life-cycle in the next season.

It was found by Mr Warburton and Miss Embleton that the mites migrated in three ways:—

(*a*) By crawling, the legs being aided in case of necessity by the projecting hind bristles.

(*b*) By attaching themselves to crawling insects and arach-

nids, and so being carried to new places for attack. In waiting for such attachment the mites were found to assume an upright position, fastened by the sucker at their tail-end.

(c) Where lodgment is not obtained on a passing animal the mite seems to launch itself into space, with the possibility of landing on a bud, or, if falling on the ground, of being carried later by a passing insect or arachnid, and so reach a bud.

### *Preventive and Remedial Measures.*

Do not plant cuttings from infested bushes.

Severe pruning. The burning of the swollen buds pulled off during the winter—*i e.*, before the mites have migrated.

Where attack is limited to a few bushes, uproot and burn; this is far better than attempting a cure.

From the life-history given it will be clear that at or about migration time—if the state of the bushes allow—would be the likeliest for any spray. Experiments with a number of different spray fluids at Woburn were not successful in result. In the Journal of the Board of Agriculture for October and November 1904 a successful spraying on a small scale is reported by Mr W. E. Collinge of Birmingham University. Some small badly infested bushes were sprayed twice a-week, beginning with the bursting of the buds in April in the various years, the spraying being continued till the middle of June. The spray fluid was composed of sulphur 2 lb., soft soap 25 lb., water 50 gallons. "The sulphur was made into a gruel with water, the soap mixed with 5 gallons of boiling water, and the two mixtures added together and well stirred, after which sufficient water was slowly added to make 50 gallons. The results obtained were very encouraging, mites being found on fresh buds only on one bush in 1901. In 1902 no mites were discoverable on the bushes, but being near some infested bushes they were again sprayed. In 1903 they were still free of the mites, and also early in 1904 no trees bore abnormal buds." Should any member of the Society try this method I would be glad if he would communicate the result to me.

### THE CABBAGE-ROOT FLY—*Phorbia brassicæ*, Bouché.

The maggots of this fly (fig. 32) are a cause of great loss to growers of cabbage, and in the past year a number of complaints have reached me concerning the destruction of cabbages both in the field crop and in gardens. The fly is an enemy of plants belonging to the natural order Cruciferæ. I have bred out the fly from maggots taken from cabbage, cauliflower, turnip, and swede. Attack has also been recorded on broccoli, radish,

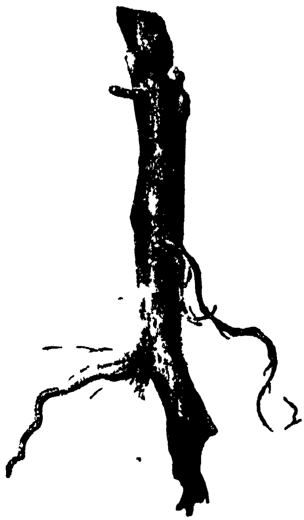
A.—Male fly, greatly magnified.

B.—Maggot magnified.

D.—Puparium, magnified.

C.—Last segment of maggot, enlarged, showing tubercles.

E.—Withered leaves of attacked cabbage.



F.—Part of attacked cabbage, with larva *in situ*.

Fig. 32.—*The Cabbage-Root Fly* (Phorbia brassicæ).

(Reproduced by the courtesy of the Board of Agriculture and Fisheries.)

garden stock, and such wild plants as shepherd's purse, yellow rocket, and hedge mustard. Attacked plants have their growth checked, their leaves discolour, wither, and wilt, infested parts become slimy, rotting takes place, and the plant falls away. Professor M. V. Slingerland [1] has written very fully regarding *Phorbia brassicæ*, and how it can be combated.

### *Description of Insect in its Different Stages.*

The adult fly measures about $\frac{1}{4}$ inch long, and there are slight differences between the sexes. The male is dark ash-grey in colour, and has three dark stripes on the upper surface of the thorax; a black stripe runs down the abdomen, each segment of which has also a narrow transverse black stripe. The body generally is distinctly bristly. The eyes almost meet on the top of the head. The legs are black and bristly, and as a characteristic, each femur has at its base a tuft of bristles. The female fly is paler in colour; the dark stripes are fainter or absent; the eyes do not occupy so much of the head, there being a distinct space between them; the abdomen is pointed.

The egg is very small but visible to the naked eye, whitish in colour, and narrow-oval in shape. The larvæ, or maggots, are white or whitish-yellow and legless; the head end is pointed, and has two dark curved mouth-hooks; the hind end is truncate, and the last segment carries on the middle of its hind surface two dark spiracles; all round the edge of this last segment are twelve little projections, which can be seen on examination with a good lens, the two lowest being larger and forked, this latter peculiarity being characteristic of the species. When full grown the maggot measures $\frac{1}{4}$ inch in length; it becomes a pupa under cover of its last moulted skin, the puparium or case being light- or dark-brown in colour and oval in shape.

### *Life-history.*

The females lay their eggs close to the plant, choosing, it may be, a crack in the soil by which they can get below the surface, so that the eggs may be laid as close to the plant as possible. In a week or more, according to the weather, the eggs are hatched, and the maggots first of all gnaw the external layers of the young roots, and then make and occupy galleries in the cortex of the main root. Sometimes the lower part of the stem is invaded, in which case the pith is tunnelled. I have taken the maggots tunnelling in the leaf-stalks of the swede. When full grown the larva passes into the soil a little away from the

[1] Bull 78. Nov. 1894. Cornell Univ. Exp. Station. "The Cabbage-Root Maggot," by M. V. Slingerland.

attacked plant, and becomes a pupa, or pupation may take place in the infested plant. The first flies of the year appear for their egg-laying towards the end of April and in May, and there may probably be three generations in the year.

*Preventive and Remedial Measures.*

1. Very early-sown plants are noticed, in Scotland at least, to largely escape, but this is with us not always very practicable, and there may be attack even on an early-planted crop. Early-planted cabbages, however, in favourable weather conditions have a better chance than later-planted ones, as the plant will have passed its tender more susceptible stage, will have made some growth, will be better able to withstand attack, and in some degree to make up for loss by the formation of new roots.

2. Protecting the cabbages by means of tarred paper or cards. This method has been tested on a large scale in America. Slingerland mentions one grower who thus protected 7000 plants, and another 10,000 to 15,000, and in both cases with great success. The measure is a useful preventive, as the flies cannot get near enough to the plants for their egg-laying; the presumption is that maggots from any eggs laid beyond the extent of the cards are unable to reach the plants. The cards used are six-sided, about 3 inches across, with a slit reaching to the centre, and with a star-shaped cut in the middle to fit well round and catch any thickness of stem (fig. 33). The cards should be placed round the plants at the time of transplanting or setting out. "To place the card in position, bend it slightly to open the slit, then slip it on to the centre, the stem entering the slit, after which spread the card out flat and press the points formed by the star-shaped cut round the stem." A tool has been devised to cut these cards, so that five to six hundred can be cut in an hour. The card must be put on carefully, so as to lie on and prevent the fly from creeping under to lay her eggs.

3. In garden cultivation, a cupful of paraffin may be added to a pailful of sand, and the sand sprinkled once a-week round the stems of cabbages. This would act as a deterrent to the fly in her egg-laying.

4. In cultivation on a small scale, picking the maggots by hand, from the plants which have been taken up for the moment for the purpose, can be practised.

5. Badly infested plants should be removed and burnt, so as to keep down the pest.

6. Slingerland mentions carbolic acid emulsion and bisulphide of carbon as successful in destroying the eggs or killing the maggots. The formula for the carbolic acid emulsion is one pound of hard soap or one quart of soft soap, dissolved in one

gallon of boiling water, into which one pint of crude carbolic acid is poured. Stir well until an emulsion is formed. For use dilute with thirty equal parts of water. This may be put on the plants so as to reach the eggs or maggots.

In the treatment with bisulphide of carbon (its fumes are poisonous, and no light must be brought near the substance), a little of it is injected into the soil near the plants, care being taken that the liquid does not reach the roots. The vapour diffuses through the soil and quickly kills the maggots.

7. Where the attack has been bad, neither cabbages or beet should immediately follow, nor any cruciferous crop. What-

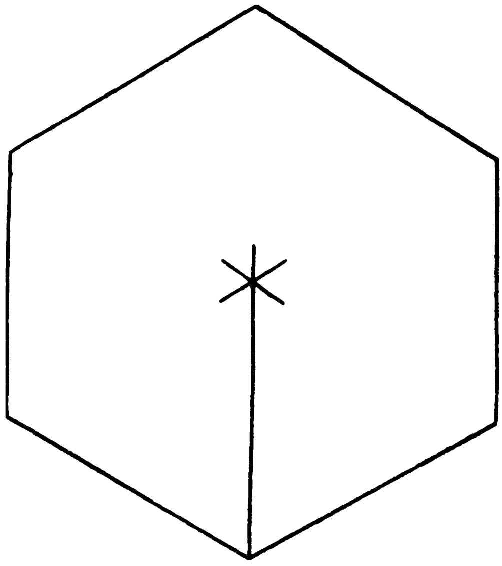


Fig. 33.—*Appliance for preventing Maggot attack upon Cabbage.*

ever rotation of crop be practised to evade the pest, it must be accompanied with the destruction of cruciferous weeds, which play the part of nurseries for the cabbage maggot.

## The Steel-blue Wood-Wasp—*Sirex juvencus.*

In the month of July 1904 a specimen of this handsome insect was sent to me with a request for its identification. The insect had been flying about in the house, having issued from the woodwork of the house, which was a new one. The insect is large and formidable looking—although quite unable to harm any person,—and the sender wished to know whether it was likely to be injurious to either house or inmates. Others

appeared in the house later. In the 'Transactions' of 1901 I reported that a number of these wood-wasps had issued from the floor of a smithy; and at various times this species has been taken in Glamorgan, Innerleithen, Cramond, Roslin, Aberdeen, Ayr, and Bute. I have also had its ichneumon parasite, *Rhyssa persuasoria*, sent to me from Glamorgan and from Bute.

*Description of Insect.*

The body of the female (fig. 34) is steel-blue in colour, with reddish legs. The smaller male (fig. 35) is also blue, but has

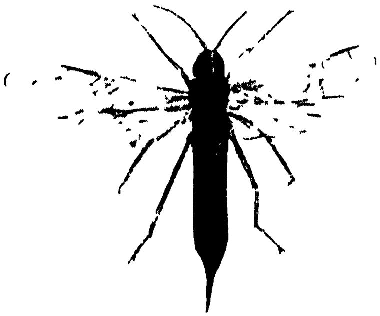


Fig. 34.—*Sirex juvencus*, female, natural size (original).

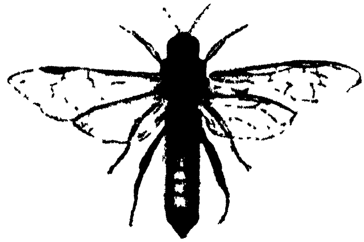


Fig. 35.—*Sirex juvencus*, male, natural size (original).

rings four to seven of the abdomen yellowish red. The wings are yellowish. There is some variation in colour, and considerable variation in size in both sexes. The size varies from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inch, and the spread of wing from $\frac{3}{4}$ inch to 2 inches. Specimens which I bred out of a Pine stem gave the following measurements: males, $\frac{3}{4}$ inch, $\frac{7}{8}$ inch, 1 inch, $1\frac{1}{8}$ inch; female, $1\frac{3}{8}$ inch.

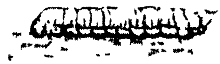


Fig. 36.—Grub of *Sirex juvencus* (original).

The grubs (fig. 36) are white, and have six very short legs at the front end, and strong biting jaws. Full grown they measure over an inch in length.

Fig. 37.—End of abdomen of female *Sirex gigas*, the giant wood-wasp, showing spine and ovipositor. Natural size (original).

*Life-history.*

The female, by her long ovipositor (fig. 37), bores a hole in the bark right into the outermost wood-rings, piercing even to the third-last wood-ring. One of my correspondents from actual observation describes the boring thus: "The wood-wasp about to de-

posit, first wanders all over the log, the point of the ovipositor and its sheath dragging against the bark, and the antennæ working vigorously until a suitable place is found. The holes are usually single or in groups of two or three, and have a small raised collar round them, the result of the accumulation of bore-dust between the bark and the wood." In each hole an egg is laid.

The grub on hatching, after following the same layer of wood for a short distance, turns inwards towards the centre of the tree, increasing in bulk meanwhile, and later on curves out again towards the surface so as not to leave too great a thickness of wood to be bored through by the adult insect when it is mature and ready to issue. As the grub pro-

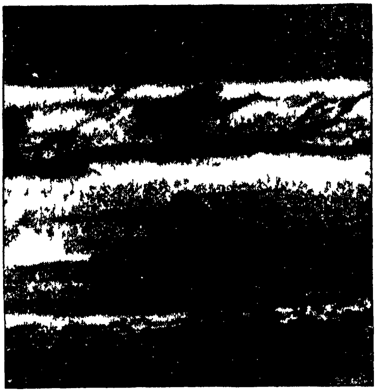


Fig 38.—*Sirex juvencus* in the act of eating its way out of pine stem after pupation Natural size (original)

Fig 39.—Pine stem, showing flight holes of *Sirex juvencus* (original)

gresses, the part of the gallery behind it is filled with bore-meal and frass. When full fed the grub pupates in a chamber at

the end of its tunnel, and when the wood-wasp is fully developed it gnaws the circular hole by which it emerges (figs. 38 and 39).

The flight time is typically July and August, on to September.

There is a lack of experimental evidence as to the length of time elapsing from the egg-laying till the appearance of the adult insect. It seems certain that the generation is never less than two years, and it is often longer. In one record I have, a floor was laid down in November 1898, the wood of which had been previously infested; in August 1900 a number of wood-wasps issued.

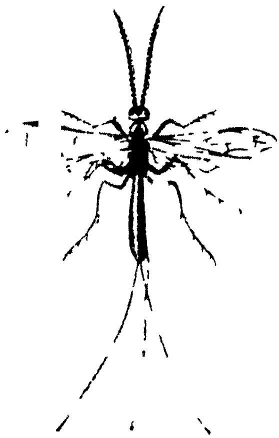


Fig 40 – *Rhyssa persuasoria*, natural size (original)

The wood-wasp chooses for egg-laying grown conifer trees that are sickly, or such as have been accidentally wounded. These should be felled and removed. Attacked stems are often rendered, by the borings of the larvæ, quite useless for technical purposes. Trees felled, and barked and allowed to lie, are also used as breeding-places.

The larvæ of *Rhyssa persuasoria*, a large ichneumon, are parasitic on the wood-wasp grubs. *Rhyssa* (fig. 40), by means of a long egg-laying apparatus, bores into a tree where wood-wasp grubs are at work, and drops an egg into a wood-wasp grub tunnel. When the egg hatches, the ichneumon larva attacks and feeds on the wood-wasp grub, ultimately destroying it.

## THE TURNIP MUD BEETLE—*Helophorus rugosus*.

During the year specimens of this beetle (fig. 41), along with injured turnips, have reached me from Aberdeenshire. It is interesting that, as far as I know, all the complaints that have been made of the destructive work of this beetle and its grub have reference to Aberdeenshire, and this in spite of the fact that the beetle is widely distributed in England and Wales, and is found in several widely separated districts in Scotland. The complete life-history of the beetle is not known, and this ignorance extends to the life-histories and food-habits of other members of the same family.

### *Harm done by Helophorus to Turnips.*

The leaves may be eaten; the leaf-stalks may be holed and tunnelled; the swollen root tubers may be irregularly gnawed and tunnelled on the outer surface, especially at the upper part. A favourite place for the pests is at the crown of the tuber, sheltered amongst the leaf-bases, the young leaves being destroyed.

The attacked leaves curl up, and attention may be drawn to the presence of the enemy by these curled leaves, which stand straight up and close together. The holes may, in the tuber,

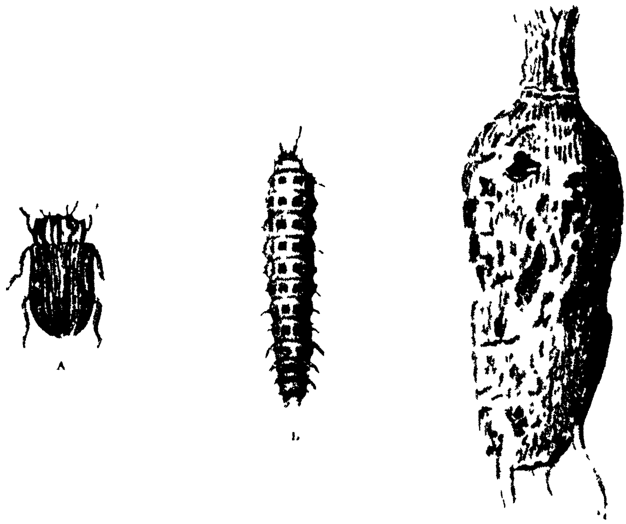


Fig. 41.—*Helophorus rugosus*. A, Beetle, magnified (after Rye); B, Grub, magnified (after Ormerod); C, Turnip, showing gnawings of grub. Nat. size (original).

afford entry to injurious fungi and to rain, and the plants may die off altogether.

### *Description of Beetle.*

The beetle measures about ¼ inch in length; it is dark-red in colour, the redness being often obscured by a covering of mud. The best known species of the family Helophoridæ live in water or mud, and the beetles are often covered with mud and dirt. In shape the beetle is oblong-oval and somewhat broad. The thorax is irregularly ridged and knobbed with its front angles prominent. The wing-covers show here and there dark markings, and between their longitudinal ridges are rows of punctures.

The legs are pale-red. The antennæ, if examined with a lens, are seen to be somewhat thickened towards the tip.

The grub has a dark-coloured head with brown jaws. The three segments behind the head carry each one pair of legs. On the upper surface of these thoracic segments is a dark transverse curved line. Down the back of the remaining segments there are two rows of large square spots, with similar smaller spots below down each side. The body ends in two processes.

Both beetle and grub are injurious, and the worst mischief is done when the plants are small.

### *Remedial Measures.*

In the present state of our knowledge of this insect, the only proved useful measure is the application of nitrate of soda as a stimulating dressing. Several correspondents testify to this as a useful measure. It has also been observed that after infestation with this grub, attack in the next season was worst on any turnip fields near a last year's infested field, therefore the next year's turnips should be as far removed as is practicable from a recently infested area.

## Corn and Rice Weevils.

The Corn Weevil (*Calandra granaria*) and the Rice Weevil (*Calandra oryzæ*) are both very troublesome to stored grain, and also to cargoes of grain in ships.

*C. granaria* is $\frac{1}{8}$ of an inch long, with the rostrum or proboscis characteristic of the weevils. In colour the beetle is brownish-black; the bent antennæ which spring from the rostrum are reddish in colour, as also are the six legs. Examined with a hand lens the thorax is seen to be covered with dots; the wing-covers are striated; the grubs are whitish, legless, with yellow-brown heads and biting jaws.

*C. oryzæ*, often found at work associated with *granaria*, is somewhat smaller and smoother than *granaria;* it may also be paler in colour, and the wing-covers show two orange-coloured patches at apex and base. *C. oryzæ* is capable of flight, whereas *C. granaria* is without flying wings.

Wheat, barley, oats, and Indian corn may be infested by the weevils; and *oryzæ*, besides, is extremely harmful to rice.

### *Life-history.*

The females lay their eggs—one egg to a grain—in a hole made in the grain, and the larva on hatching feeds on the contents of the grain, and when full fed becomes a pupa in the hol-

lowed-out grain. The weevil when ready issues from the grain; and, in addition to laying the eggs, is directly harmful by puncturing and feeding off the grain.

The length of time taken from the laying of the eggs to the development of the perfect beetle varies much with the conditions. At a temperature of 80° F. and with the other conditions favourable, the whole life-cycle can be completed in about a month. At lower temperatures a longer time is taken.

*How to rid Grain of the Insects.*

1. *By sieving or screening.*—The infested grain is run through a sieve or down a screen whose meshwork is sufficiently fine to keep the grains back and yet let the beetles run through, these being caught in a vessel arranged below for the purpose, and containing paraffin.

2. *Fumigation.*—This is the best measure, the fumigating being done by using bisulphide of carbon. The liquid volatilises readily, and the vapour, being heavier than air, sinks. To use the bisulphide of carbon against these weevils: place the grain to be treated in a bin or air-tight receptacle, pour into a saucer or shallow vessel some bisulphide of carbon, and then lay the saucer on the top of the grain. Leave for twenty-four hours after closing the receptacle holding the grain. The fumes sink through the grain and kill all the insects. Two pounds of bisulphide of carbon are sufficient to fumigate one ton of grain. In disinfecting a store or a mill, one pound of bisulphide of carbon is sufficient for every 1000 cubic feet of space. Before entering the mill after such fumigation the doors and windows should be thrown open for an hour or two in order that the place be well ventilated.

Bisulphide of carbon has a very disagreeable odour, and as the fumes are poisonous, they should not be breathed by the user. As the substance is also explosive, a naked light must not be brought near it, not even the lit end of a cigar.

*Weevils in Ship Cargoes.*

During the past year I was consulted several times as to the conditions under which these grain weevils might be expected to increase in numbers during the transit of the cargo.

Disputes are not infrequent in connection with badly weeviled cargoes of grain as to where responsibility rests for the damage, —whether the sender or the carrier should bear the blame, or whether circumstances may have been exceptional. In one such case in which several of our members were interested I had occasion to receive and report on some of the damaged

material. I was associated with my friend, Mr Frank J. Cole, of the University of Liverpool, and although my own experiments to clear up difficulties are not yet completed, I have Mr Cole's permission to quote his conclusions. In all arguments as to development and spread of weevils in a cargo of grain, the very important conditions of temperature, moisture, and presence or absence of oxygen take a foremost place. Mr Cole's general conclusions as to the conditions favourable to the life and propagation of grain weevils may be summarised thus:—

"1. Heat is necessary, the most favourable temperature being about 80° F.

"2. Moisture must be present, and in the form of water vapour, because in such a form the grain is not affected so as to prejudice the life and feeding of the grub inside it.

"3. The atmosphere should preferably be close and confined, not so much because this condition is favourable in itself, but because a close atmosphere favours a rise in the temperature and the accumulation of water vapour. Therefore ventilation is injurious to the weevil, because the temperature is thereby lowered and water vapour carried away. Weevils can live with exceedingly little oxygen, and hence a confined atmosphere is not prejudicial to them.

"4. Weevils will sometimes breed in 'dry' grain (so-called), stored in sacks or in bulk (but *not* to any dangerous extent), because grain so stored may not be thoroughly dry and free from water vapour. But the small quantity of the water vapour present is insufficient for any *extensive* breeding. In grain taken in small quantities and kept at a temperature of 80° F.—*i.e.*, in grain that is kept really well dried and even at the most favourable temperature—the weevil finds it impossible to live.

"5. Carbonic acid gas in the quantities in which it can possibly collect in ships' cargoes and stored grain has no effect on the weevil.

"6. If a cargo arrives in a bad condition of weevil, and if it can be established beyond all question that that cargo has been kept ordinarily and uniformly dry, only one conclusion is possible, and that is that the grain must have been badly infected by weevil eggs or by the weevils themselves before it was shipped. The adult weevil requires much more moisture than the grub, and hence it comes about that a *slight* condition of weevil in a *dry* cargo would be produced by the hatching out of eggs already there; but the dryness being sustained, the weevils so produced could not and would not breed quickly enough to produce any appreciable damage. And similarly, *serious* weevil damage in a *uniformly dry* cargo can only be produced by serious weevil infection before shipping. Assuming that the grain would not be seriously infected with the

adult weevils, such infection would be in the form of the weevils' eggs cunningly concealed in the grain, and could not be detected except by a scientific examination of the whole cargo—commercially and practically out of the question."

I consider these conclusions of Mr Cole a valuable contribution to the literature of the subject. Some of them are opposed to opinions that deserve respect; but I hope in another year to deal with various opinions, and to adduce experimental evidence.

## Grub on Oats.

During the past year complaints were frequent as to the destructive work of the Leather-jacket or Daddy-longlegs grub, the complaints reaching me being chiefly from Forfarshire and Aberdeenshire, where much harm was done to lea corn. The leather-jacket grubs are of various species of Tipulidæ or Crane-flies, the well-known awkward-looking flies receiving this name from the snout that projects somewhat from their head and from the long, sprawling, easily broken legs.

The general life-history is that the females lay numerous eggs on the ground, pasture being a favourite place. From the eggs hatch grubs, which live in the soil, gnawing the roots of plants; they come to the surface at night, and destroy leaves—*e.g.*, the young leaves of corn. Many different plants may be attacked—flower-plants and vegetables in gardens, and crop-plants in the fields. The grubs are earth-coloured or rust-coloured, and have small hard heads with short antennæ. The head bears a strong pair of mandibles which bite against the teeth of another pair of jaws; this head can be restricted within the segments that follow it. Round the margin of the hind end of the grub there are little projections, and on the hind surface of the last segment are the two openings which lead into the breathing tubes. The larva known as leather-jacket, because of its tough strong skin, is very resistant to such external influences as frost or water; and I have known them to survive when placed on the surface of not too hard soil and the roller put over them.

When the leather-jacket is full fed, it moults its last skin and becomes a pupa. After a short stage of rest—it may in the summer-time be only a fortnight—the pupa, by the aid of a series of little hooks on the abdominal segments, wriggles to the surface, where it may be seen standing erect with quite half of the body projecting above the surface. The head end carries two little tracheal horns or processes by which respiration is accomplished. At length the skin cracks on the upper surface at the front end, and the daddy-longlegs or mature fly issues.

There are several species of Tipula, the best-known three being *Tipula oleracea*, *Tipula paludosa*, and *Tipula maculosa*.

All three may be present, or two of them, at the same time, or infestation in a district may be due to only one of them. There is room for accurate observations on the length of the life-cycle and the number of generations in a year—one or two—of the various species. I have some evidence that, in the case of one of them at least, the grubs are full fed rather earlier in the year than is generally thought: the significance of this as regards late sowing will be referred to presently.

Generally it may be said that the measures of prevention and remedy adopted against the crane-flies in relation to corn are: the early ploughing of grass and clover leys, care being taken to have the grass well covered. The intention underlying this practice is to have the land ploughed before the crane-flies in large numbers have proceeded to their egg-laying in August and September. Grub is worst on corn after grass, and the intention is to deprive the females of the chance of laying on the pasture. Failing the possibility of a July ploughing, it is recommended to dress grass and clover leys with gas-lime, three to four tons to the acre. Gas-lime is fatal to eggs and grubs.

In the north of Scotland during the past three years there has been great loss of crop on account of these grubs. I have received a communication as to the grub infestation from Mr William Forbes, Newark, Ellon, Aberdeenshire; and as Mr Forbes writes with a fifty-five years' experience as a farmer, his opinion and advice as to the advantage of late sowing in dodging the leather-jacket grub deserve attention.

Mr Forbes finds that the grub, small and not easy to distinguish in December, is not difficult to find in January when it has grown somewhat; growth continues during February and March, the leather-jackets feeding on the roots and leaves, &c., of the ploughed-up pasture. Then "when oats are sown, say in the second week of March, the grubs do not seem to pay any attention to the sprouting corn until some days after the braird appears above ground, about the end of the month. The grubs at this time show a power of locomotion one would scarcely expect from their appearance. They now at night come to the surface, where, meeting with and tasting the succulent leaves of the young corn-plants, they afterwards feed greedily on these (as well as the roots), so that the young plants are quite destroyed, the fields sometimes becoming bare in great patches."

Mr Forbes believes that if the sowing of the oats can be postponed till April—he is, of course, referring to the northern counties—much of the crop will escape, as the grubs, before the young plants are ready for them, will have to a great extent done the most of their feeding, and be approaching their full-fed condition. "While when the grubs are very numerous extermination of the early sown crop may take place, there can

be no utter extermination if the oats be sown during the first week of April, because oats sown at this time will only braird during the last week of April, when, although the grubs will attack it, a great deal of their growth has taken place. Oats sown in the second week of April will not be hurt by grub in average years, and will not be seriously hurt in the worst of years, while oats sown in the third week of April, and therefore not showing itself above ground till the middle of May, cannot be hurt at all."

Mr Forbes admits, of course, that late sowing has its disadvantages as far as the practice of the farm is concerned, but believes that these are counterbalanced by advantages. He practises this late sowing himself, and writes that last year (a very bad year for grub) he advised some of his neighbours to sow in April, and those who followed the advice escaped the serious loss suffered by early sowers on adjoining fields. Still, there is always the risk of the crop failing to come, if sown too late, should the weather be too dry, and some will consider this a greater risk than the grub.

As a remedial measure where the grub has got to work on the young oats, the crop should receive a dressing with nitrate of soda, 1 to 2 cwt. to the acre. Where the crop is evidently beyond saving, then it should be ploughed up, and some other crop—according to the locality and conditions—planted. White turnip, rape, and mustard have been recommended in this connection by the Board of Agriculture. Mr Forbes tells me of two fields in Kincardine, where the oats were eaten bare by grub, being ploughed up again. One of the fields was then sown with barley and the other with swedes, and at the time of writing both fields promised large crops.

## SOME FEATURES OF DAIRY FARMING IN DENMARK.

By Wm. Bruce, B.Sc., F.H.A.S., Edinburgh and East of Scotland College of Agriculture.

Dairying in Denmark, as practised at the present time, was initiated some thirty or forty years ago, when the Danish people, crushed and almost ruined by the disastrous war which terminated in 1864, were compelled to look around for means of retrieving their position. The difficulties at this crisis in their history, there is good reason to believe, were greatly aggravated by the impoverished condition of their land. Denmark had

formerly been known as one of the chief grain-growing countries in Europe, and the practice of growing autumn-sown cereals, usually prepared for by bare-fallowing, had brought their land, which is mostly light and porous and little suited to bear the strain of this system of cultivation, into an exhausted condition. It is not necessary to enumerate here the patriotic and able men, like Professor Segelcke, who laboured till they almost lost heart, in guiding their countrymen through this trying time which marks the transition of Danish agriculture from corn-growing to dairying, and at the same time the turning-point in the fortunes of the agricultural community and the foundation of the general prosperity of the country. They ultimately succeeded, and dairying has not only been adopted, but organised and conducted with such systematic precision and success as to make it the admiration of all who have seen it.

### *Breeds of Cattle.*

One of the great difficulties that beset the Danish farmers in adopting dairying was the want of suitable cattle. While corn-growing was pursued, cattle were neglected. The native cattle comprised two distinct breeds. One, a breed of scrubby red cattle possessing no special characteristics of value, and comparable to light Ayrshires in size, which was common to Norway, Sweden, and Germany, and which was known in Denmark as the red Danish or Zealand cattle, because they were, as they are now in their improved form, the common cattle of that island, and also of the southern part of the country. The other breed is known as the black-and-white or Jysk cattle of Jutland, or the northern part of Denmark. They are larger and of heavier build than the red cattle, and were formerly kept for beef production. With these two breeds as their raw material, the Danes commenced systematically to build up herds of reliable dairy cattle.

The red Danish breed was considered to be so inferior as to make it a waste of time to attempt to improve it without the introduction of fresh blood. At this stage experiments that had been conducted by private individuals were valuable, as they indicated that this breed crossed well with the allied races of cattle found in Schleswig, and that the animals produced were hardy enough to stand the climate of Denmark, which was not the case with some other crosses that had been tried. By careful selection and breeding, aided at the outset by the introduction of fresh blood from Schleswig bulls, the small, scrubby, red cattle have been changed into a breed of fixed type, and taking size into consideration, of almost unequalled capacity for milk production. A fine specimen of

this breed is represented in fig. 42, whose milk record is as follows:—

Cow No. 32 at Kolle Kolle, calved 15th March 1898.

Milk record since bearing her first calf.

| Season. | Milk lb | Butter-fat Per cent | Butter yield lb |
|---|---|---|---|
| 1900-1901 | 8,397 | 3·66 | 343 |
| 1901-1902 | 8,449 | 3·70 | 348 |
| 1902-1903 | 12,134 | 3·71 | 501 |
| 1903-1904 | 12,258 | 3·88 | 530 |

530 lb. butter at 1s. = £26, 10s

Similarly, the large-framed, black-and-white, beef-producing cattle of Northern Denmark have been selected, and bred,

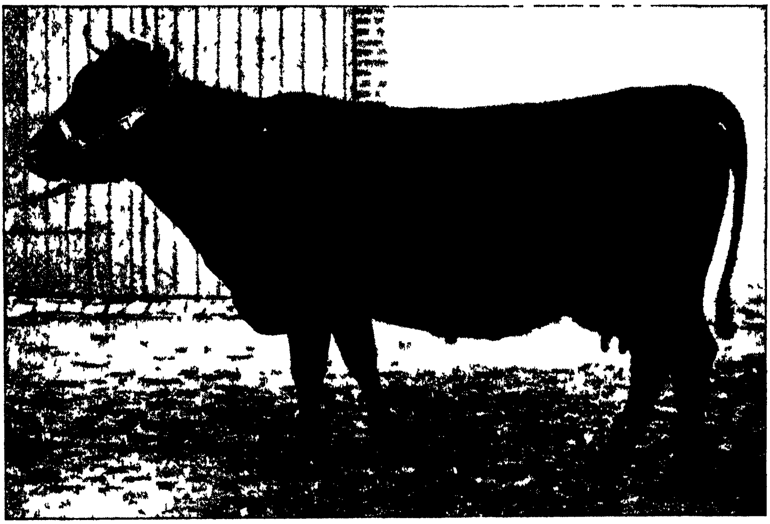


Fig. 42.—*Red Danish cow.*

probably with the assistance of some Dutch blood, into a dairy breed; and it is interesting to note that this has been accomplished without loss of substance (fig. 43).

Both breeds have their good points, and being about equally good milkers, there is naturally a good deal of rivalry between them. At the present time their excellence is being maintained, and further improvement in their qualities looked for by a constant continuation of careful selection and weeding out in breeding; and as some of the methods adopted by the Danes in pursuing this policy are almost novel to us, an account of them cannot fail to be of interest.

*Breeding.*

Milk records are carefully kept, and only the bull-calves whose ancestors have given a heavy yield of milk with a high percentage of butter-fat are retained for stock purposes. If a Danish farmer is asked if his bull is well-bred, the prompt reply will be that his dam had a milk record of something like 9000 or 10,000 lb., containing 4 per cent of butter-fat, and much more to the same effect. Thus only a few very well-bred bull-calves are kept, and only those come of a very good milking strain; the remainder are fattened when young and sent to the butcher for veal. Most of the heifer-calves, however, are reared and served, and the less profitable ones are afterwards weeded out in the process of selecting the best.

The young bulls from well-known stock in good herds are

Fig. 43.—*Jysk cow.*

keenly sought after and command good prices, as much as £60 being frequently paid. Moreover, bulls that prove getters of profitable progeny are not disposed of after two or three years' service as they usually are in this country. They are not only retained till they see the good old age of twelve or fifteen years, but a bull who has proved his excellence is carefully reserved for mating with the best cows.

In Denmark, breeding of profitable cattle, like many other branches of agriculture, is fostered by well-administered State assistance. By a thorough organisation of the officials belonging to the State, the agricultural schools, the experimental

stations, the National Agricultural Society, and the farmers' own co-operative concerns, the Government keeps in close touch with the interests of the farming community.

A visit paid on the 24th June to an agricultural show held at Skanderborg, near Aarhus, provided a good example of the application of State assistance to cattle-breeding. At this show 240 head of stock were seen on exhibition, and among these 84 bulls. In the showyard it was very evident that the methods adopted in judging cattle in Denmark are very different from those in use in this country. About one-third of the bulls at the show received premiums ranging from £4 to £5. These premiums are given to all bulls of a certain standard, and carry no restrictions as to fees or service. In the younger classes, bulls are judged by their individual appearance only. But in the older classes above three years, while judged first, second, third, &c., for individual appearance, the premiums are granted to bulls according to their progeny. Those of five years and over must have three years' stock, ten from the first season, twelve from the second, and fourteen from the third. These are judged before the show, and the premiums awarded to the bulls accordingly. In this class some very old bulls were shown, and received premiums on account of the quality of their stock.

These old bulls are shown in what is known as the State class. The premiums are given by the Government, and the bulls come from all over the province. In the younger classes local exhibitors only compete, and half the prize-money is given by Government, the other half is raised locally.

Another interesting feature of the Danish showyard is the method of judging cows. They are all shown in groups of from two to five (fig. 44), and in awarding the prizes the milk-yield is the chief factor. But the quantity given on the show day is not accepted as the criterion; it is the carefully-kept records which give both the quantity and the quality over a year, or such period as may be decided upon. Premiums for the encouragement of breeding are given by Government for the best lots. The cows shown at Skanderborg were practically all of the black-and-white breed, and they were quite true to type, although none of those exhibited on this particular occasion were recorded in the herd-book.[1]

The cattle were all shown in their natural condition.

Another factor which has had a very great influence on the breeding and improvement of cattle, and indeed all classes of

[1] A herd-book has been established at Aarhus for the Jysk cattle, and another at Copenhagen for the red Danish breed. But so far, entries are mostly confined to bulls. These must have produced stock before they can be entered, and milk-yields must also be recorded when entering an animal in the herd book

farm stock in Denmark, is worthy of more than passing interest. Every one is aware that Denmark is essentially a country of small holdings. The great majority of the farms do not exceed a few acres. In our own country experience indicates that small farmers, even when sufficiently advanced in their ideas to appreciate the importance of securing bulls and the like to improve their stock, are usually debarred from their use for want of means to pay the price. There is no reason for assuming that the Danish small holders are any better off in this respect, but they have overcome this obstacle by co-operation. They have been educated into a thorough appreciation of the

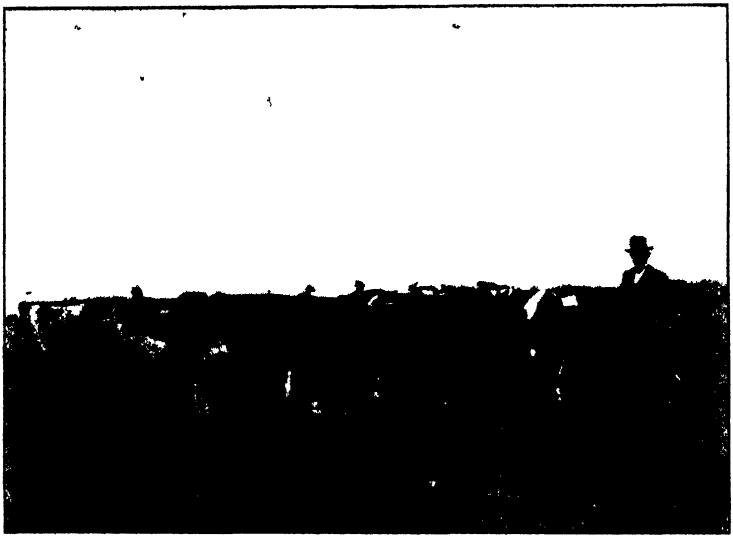


Fig 44.—*Group of Jysk cows.*

importance of mating their carefully-selected cows with a first-class bull, and when a number of these small holders desire the services of a good one, they unite and approach the Government stock-expert in their district, and on his advice a bull is selected. The price is provided by the members each paying so much per cow. The bull is reserved for the members of the union, and is placed at a centre and the farmer paid for his keep; but outsiders may sometimes be permitted service for a fee. The effect of this system has been to greatly improve cattle on small holdings, where an average of 700 gallons of milk per cow per annum is no uncommon thing. Statistics show that the average of 74,600 cows in Funen, two years ago, was 5500 Danish pounds of milk, or 592 imperial gallons.

### *Dairy Management.*

Let us now turn to the dairy-farm management of the Danes. We have seen how they breed their cattle. From the butcher's point of view their cows are not much to look at, but they do look like the purpose they are there for, which cannot be said of many that are kept nearer home. The Danish farmer believes in the gospel that "cows are for giving milk," and his success in realising this forms an object-lesson worthy of careful consideration from all breeders and feeders of dairy stock. In the byre at the head of each cow attention is attracted by a small black-board with a few figures in chalk. It is here that the farmer from this country begins to realise how careful and painstaking the Danes are, and how far ahead of us they are in the selection and management of their cows. We here reproduce one of those black-boards:—

| | | | |
|---|---|---|---|
| (1) | Nyborg | | 2 |
| (2) | | 21A | |
| (3) | | 5AAR | |
| (4) | 7420 | 4·02 | 334 |
| (5) | 9450 | 3 63 | 383 |
| (6) | K28/11 | | L4/3D |
| (7) | 49 | 27/4 | 36 |
| (8) | | Klass II. | |

The writings on this board, to those who understand them, give information at a glance on the following points:—

(1) The sire of the cow, and her number in the byre.
(2) The cow's number in the Kontrol Society's books (see p. 237).
(3) The cow's age.
(4) The quantity and quality of milk given by the sire's dam, the percentage of butter-fat which it contained, and the quantity of butter,—all in Danish pounds.[1]
(5) The cow's yield of milk for the last season, the percentage of butter-fat which it contained, and the quantity of butter.
(6) When the cow calved, and when she is expected to calve again.

[1] A Danish pound $= 1\frac{1}{10}$ lb. imperial.

(7) The highest yield of milk the cow has given since she calved last—49 lb. (Danish) in this case; and the date when this maximum yield was obtained, and also the present yield (36 lb.) The latter on some farms is ascertained and recorded daily, on others periodically.

(8) The class into which the the cow's yield of milk entitles her to be placed. (The cows are fed according to the class in which they are placed in, or, in other words, according to their yield of milk.)

Thus the Danish farmer has continually in sight, for the guidance of himself and his servants, information of great value in the economic management of his stock. He always keeps his object well in view. The Danish farmer breeds for milk; his idea of pedigree is utility and profit. This he measures daily, and any animal found wanting is speedily discarded. His efforts to secure his ideal, pursued with remarkable perseverance, have been crowned with great success. On the best-managed farms an average yield of 800 gallons of milk is quite common, while a scrutiny of the carefully-kept records seldom discloses a cow whose milk falls below our 3 per cent standard of butter-fat. Indeed, many have a record of over 4 per cent, and the Danish farmer counts on getting a pound of butter from 2½ gallons of milk.

That the milk-producing capacity of the Danish cattle has been enormously increased during recent years, is a matter beyond doubt. Of this there was abundance of reliable evidence at many of the places visited. The carefully-kept records over a number of years show how the average milk-yield has increased at some of the best-managed farms a hundred or more gallons in a few years. Kolle Kolle, one of the farms visited, may be cited as an illustration. Here the stock is under skilful management. Every care is exercised to select and breed profitable dairy cattle. The cows are carefully mated with bulls of good reputation. At the time of our visit one of the bulls was thirteen years of age, and a choice young bull four years of age, out of a cow with a record of 9134 lb., or nearly 900 gallons of milk containing 4·29 per cent of butter-fat, was ready to take his place at the head of the herd. The Essex farmers' party visited this farm in 1900, and recorded the average milk-yield as 7150 lb. (about 700 gallons); last year it reached 8847 lb., or about 824 gallons.

## *Feeding.*

Although the main factor in establishing these wonderful milk records has been selection and breeding, with this has been coupled judicious and skilful feeding. The Danish farmers send

their milk to their own co-operative creameries, and as the milk has to be fit for the manufacture of superior butter it is all carefully examined on arrival, and if found contaminated in any way by bad handling, or tainted by the use of any particular kind of food, the farmer is warned at once, and if to this warning immediate attention is not given, he is liable to have his milk rejected and to be expelled from the combination.

Thus the farmers, as directors of their own creameries, have had to impose upon themselves somewhat stringent regulations for controlling the production of milk. Turnips and other foods that taint milk are either forbidden or used sparingly. Complex rations are recommended, so that there may be no undue proportion of any one food in the diet; while certain feeding-stuffs can only be used along with an allowance of rape-cake, which is considered an excellent food for the production of high-class butter. The careful attention given to these regulations has no doubt been a potent factor in making the Danish farmers eminently skilful feeders of cows.

The system of feeding adopted is to regulate the food according to the cow's capacity to produce milk; and in order to simplify this the Danes have adopted a method of reckoning the food by standards.

One standard of food is:—

| | | | | | |
|---|---|---|---|---|---|
| | 1 | Danish pound | ½ oilcakes[1] . . . ½ bran and oats | = $1\frac{1}{10}$ | lb imperial. |
| Or | $2\frac{1}{2}$ | Danish pounds | hay . . . | = $2\frac{3}{4}$ | " |
| Or | 10 | " | beetroot[2] . | = 11 | " |

Four standards of food with a foddering of straw is considered sufficient for the maintenance of a cow's body in good condition, and one standard for each 3 Danish pounds (3·3 lb. imperial) of milk produced. Thus a cow that gives 30 Danish pounds (33 lb. or nearly $3\frac{1}{4}$ gallons) of milk would be fed on fourteen standards of fodder, which might consist of—

| | | | | |
|---|---|---|---|---|
| 40 | Danish pounds | (44 lb.) | beetroot . . | = 4 standards. |
| $7\frac{1}{2}$ | " | ( $8\frac{1}{4}$ lb.) | hay . . . | = 3 " |
| 7 | " | ( $7\frac{3}{4}$ lb ) | oilcakes, bran, and oats | = 7 " |
| | | | | 14 standards. |

This system of feeding according to milk production is highly commendable, being eminently scientific, economical, and profit-

[1] Oilcakes here means a mixture of cakes; as a rule the cheaper cakes are used, such as rape, sunflower, cotton, earth-nut, &c.

[2] Or an equivalent quantity, according to composition, of other roots, such as mangels, kohl-rabi, carrots, &c.

able. Indeed, the bran mash, the mealy drink, and the little extras that many of us have seen the newly-calved cow, or the cow in full milk, favoured with by our mothers and grandmothers, endorse it. But it cannot be said that it is practised in this country with the care it deserves, if, indeed, it receives much attention at all.

The advisability of regulating the food according to the milk production seems so obvious that it should require no advocacy. The only objection with any show of feasibility that might be raised against doing so is the extra bother in carrying it out. But this is often very much exaggerated. It must not be supposed that the Danish farmer laboriously weighs out all the food or each animal's portion. All that is done, or indeed it is necessary to do, is to acquire an intelligent idea of the quantity of food that is being handled. A *sine qua non*, however, is an interest in the work; and this, with a knowledge of the capacity of the ordinary utensils used, a little care in dealing out the food, and the controlling influence of an occasional weighing, makes it easy to measure out with a wonderful degree of accuracy the rations of farm stock. But unless the head of the establishment displays some interest in the matter, and spends time and thought in systematising and initiating the work, the attendant can hardly be expected to undertake it with good grace; nor can he be accused of being too apathetic to execute it skilfully. In Scotland the man who feeds the cows often knows little or nothing about the quantity or quality of milk each cow is yielding. In Denmark the black-board at the cow's head tells at once not only the quantity and the quality of the milk, but also the class the cow occupies, and consequently the quantity of food she is entitled to receive. Hence feeding according to milk production becomes a simple matter.

### *Control.*

In order to understand the origin of the successful dairy-farm practice in Denmark it is necessary to know something of the system of "Kontrol," which has been universally adopted. Although Denmark has probably the best educated rural population in the world, it must not be supposed that every small farmer possesses the knowledge of an expert. They have in every district agricultural schools to which young men and maidens resort for instruction; they also have lectures and meetings for instruction and discussion in country districts. But the main feature of their education is not technical at all: it is the attention given to the formation of character, with the view of stimulating national life and patriotism. On this

foundation flourishes the principle of working hand to hand for mutual benefit.

Their agricultural instruction, although excellent as far as it goes, is not sufficient in itself to make the Danish small holder the successful farmer he is, but it quickens his intelligence as a follower. His success is due to co-operation and expert guidance. The Societies of Kontrol established all over the country on the initiative of the Royal Danish Agricultural Society may be cited as an illustration of this, and also of enlightened combination being pushed in a direction hardly thought of in this country. They are essentially combinations for controlling the breeding and management of cows, but at the same time they bring equally to every farmer the opportunity of adopting with advantage expert advice on scientific and systematic methods of conducting farm practice.

The farmers of a district form a society on co-operative lines. A combination of holders, possessing 700 to 1000 cows, is sufficient to form a local society, and for the appointment of an inspector by the Royal Danish Agricultural Society to take charge of it. The ideal inspector is a man who has been brought up to farming and who has undergone a course of training in the Agricultural College at Copenhagen, and when properly qualified he is a valuable agent in stimulating improvement in farm practice. His duties may be summarised as follows:—

He keeps a set of books of each farm in duplicate, one being retained by the farmer. He goes to each farm in the society regularly about once in two or three weeks, and there records fully in his books all particulars relating to the farm since his last visit.

The matters that naturally occupy his special attention on an ordinary Danish farm are the total amount of milk given by each cow, and the percentage of fat contained in the milk. From these he is able quickly to ascertain the percentage of butter-fat and to calculate the amount of butter produced by each cow. He also records the amount of food which has been consumed, and from these data he is able to advise as to the food required by the cows in order to yield the best results, each cow being classed and fed according to her capacity to give milk. The inspector and the farmer have thus in their books reliable information about the breeding of the cows, their past record, the date of calving, the total amount of milk given per annum by each cow, its yield of butter, and the relation between this and the food consumed, and, consequently, data is accumulated of great value in the skilful and economical management of cows. The inspector also advises, when required, as to manures, selection of seed, and change of crops. He knows

about the bulls and boars kept by the live stock societies, for this is also done by co-operation; he keeps in touch with those in charge of them, and is able to advise as to which bull the cows should be taken, and to which boar the sows should go. If a farmer has a cow which does not produce good milk, the inspector advises that she should be sold, and that she should not be used for breeding purposes.

Inquiry among the farmers made it quite clear that they appreciate the advice given by the inspector, and have no hesitation about following it, and that they are quite ready, even at a loss, to dispose of the cows that do not come up to their standard.

The books made up by the Kontrol Society for the farmer give him exact knowledge of his business. All this is obtained for a charge which varies according to each society, from a minimum of one kroner (1s. 1⅓d.) to a maximum of two kroners per cow per annum. This money, supplemented by State aid, goes to pay the salary of the inspector or "kontroller."

The value to the farmers of this form of Kontrol is very great The exact information about every branch of his business and the knowledge of how he stands in each case, makes him a more intelligent and keener farmer; and the visits of the expert, in addition to providing helpful advice on the spot, give him at small cost the benefit of an expert audit of the business of his own farm.

It is beyond the scope of this article to deal with the splendid organisation of the Danish farmers for the manufacture and disposal of their dairy produce They co-operate for the collection of their milk, which is removed from each farm or from the end of the service road leading to it, and pasteurised separated milk, sufficient to meet the requirements of each farm, is brought back. Thus no time is wasted by each holder delivering his own, and the unsettling influence too often associated with milk delivery is avoided. In order to have their milk economically and skilfully converted into butter and other products of uniformly superior quality, they loyally support co-operative creameries. The creameries are organised and work in unison, so that the farmers' produce is controlled, graded, and, by extensive business ramifications at home and abroad, it is placed on the best market with the least expense in the shortest possible time. Moreover, the man with a few cows can practically dispose of his produce with the same advantage as the man with many.

# THE PROTOZOA AND THEIR RELATION TO DISEASE.

By Dr R. Stewart MacDougall, M A., Consulting Entomologist to the Society.

The Protozoa are the simplest of animals, for the most part microscopic in size, and consisting of a droplet of protoplasm —sometimes naked, but generally surrounded by a limiting membrane — termed a cell. These single-celled animals are found in very varied situations—on land, in the sea, in rivers, in stagnant pools, as parasites in living animals. Consisting of a single cell, there is nothing of the division of labour characteristic of the higher animals, the single cell being an individual capable of performing all the necessary functions—feeding, breathing, excreting, moving, &c.; and this statement practically holds true even where numbers of these tiny forms live together in colonies, the cells of the colony retaining their individual entities.

One of the simplest of them is Amœba, a naked droplet of living matter of irregular outline, living in mud at the bottom of ditches and stagnant pools, and moving by sending out blunt processes of protoplasm, into which the rest of the living matter flows, and the animal thus changes its position. By similar processes Amœba envelops its food, the food particles—minute pieces of organic matter—sinking into the protoplasm. There is complete absence of mouth or of any organs characteristic of the vital processes of higher animals. In favourable conditions Amœba grows, and multiplies by its protoplasm dividing into two parts, this division having been preceded by a division of the nucleus—a specialised piece of protoplasm characteristic of living cells.

The well-known pest in turnips, *Plasmodiophora brassicæ*, the cause of finger-and-toe, is regarded by many not as a plant, but as a Protozoon not far removed in relationship from Amœba. In its vegetative form *P. brassicæ* resembles Amœba in having its protoplasm naked, as also in its movement by sending out processes of protoplasm. These naked pieces of protoplasm invade the roots of the turnip, live off the cell-contents, and ultimately destroy the root-tuber. The little pieces of protoplasm may run together to form larger pieces. At a later stage in the life-history, the protoplasm breaks up into a number of parts called spores, and in this way the finger-and-toe pest differs from Amœba. Each spore gets surrounded by a wall

of cellulose, and in this condition is enabled to withstand conditions that would prove fatal to the ordinary naked protoplasm. On the return of favourable conditions the wall of each spore ruptures, and gives exit to a naked motile droplet of protoplasm, which may fuse with other pieces to give the ordinary vegetative condition. Of the same nature, but living on decaying organic matter instead of preying on a live host, are the often brightly-coloured slimy patches to be seen on oak-bark in tan-yards, or those to be found on wet palings.

Other related Protozoa have their living matter surrounded by shells of carbonate of lime (Foraminifera) or of flint (Radiolaria). These live in the sea, and the shells, on the death of the protoplasm, gradually sink to the sea-bottom. The chalk cliffs of the South of England consist largely of the shells of Foraminifera; the ooze at the bottom of the Atlantic consists to a great extent of the shells of one called Globigerina; and the Pyramids of Egypt are built of a limestone composed of the shells of another large species.

All the forms mentioned so far have been comparatively sluggish in their movements, but there are others with a body of well-defined shape which are able to move rapidly by means of *cilia*, or by a lashing flagellum or whip, and these may have a groove or mouth for taking in food material. An interesting flagellate form is *Euglena viridis*, found in fresh-water pools, which can nourish itself like an animal, but in virtue of its green colouring matter is able also to feed like a plant. To the flagellate section belong also the parasitic Trypanosomes, to be mentioned later for the part they play in Tsetse Fly disease and in Sleeping Sickness.

*The Sporozoa.*

While the great majority of the Protozoa in the preceding sections are free-living, with only a few occasional parasitic members, the section Sporozoa has its members all parasites. Their protoplasm is surrounded by a limiting cuticle, so that the species have a more or less definite shape, and it is divided into a denser outer layer and a more fluid internal layer. There is no trace of a mouth, the food material obtained from their host simply sinking into them over the surface. While some, at certain stages in their life-history, have a power of movement by processes of the protoplasm, typically the whole group is sluggish, with a complete absence of *cilia* or lashers. A great characteristic is their power of rapid multiplication by spores, which are pieces of protoplasm that result from the dividing up of the protoplasm of the adult. By means of these spores the species increases its numbers; the spores also serve

for the conveyance and spread of the parasite to other hosts. As the spores, before reaching a suitable host, may have to resist untoward conditions, a protective resistant wall is characteristic. In some cases the parasitic Sporozoon is spread by the agency of an intermediate host—*e.g.*, malaria in man is carried by a mosquito, and the parasite of Texas fever is carried by a tick; but in most cases infection is accidental and without the intervention of any carrying animal.

Some of these parasitic forms infest the actual cells of the host; others live in cavities, like the intestine and body-cavity. Practically all classes of backboneless and backboned animals can harbour these parasites. Their influence in the life of the host varies very much with the species of parasite and with the host; some seem to cause no inconvenience to the host, while others may accomplish the death of the host; between these two extremes there are all degrees of toleration and of interference with the health of the host.

While it would be an exaggeration to say that each species of Sporozoon parasite has its one specific host, yet, generally, it may be said that the range of host open to a particular species of parasite is a limited one, each parasite conforming itself to hosts that have a certain degree of relationship, and limiting itself in its infestation to the same cavities or organs. This fact of the adaptation of a parasite to certain special conditions, and to certain special feeding-places, as it were, is a very interesting one biologically, and we have called attention to it before in our previous communication on the parasitic worms.

### *Classification of Sporozoa.*

Order *Gregarinida.*—The Gregarines have a somewhat elongated worm-like form, some of them having their body partly partitioned into two, an anterior portion small, and a larger posterior portion which contains the nucleus; others show no trace of partition. They are cell parasites in their youngest stage, but they live in body-cavity or alimentary canal when adult. The hosts they infest are invertebrate hosts—*e.g.*, insects and worms—and to these hosts they are almost harmless. We will take as a type *Gregarina blattarum*, the Gregarine found in the intestine of the cockroach. This worm-like Gregarine has its protoplasm surrounded by a protective limiting cuticle, and showing an external denser portion and an internal more fluid portion. Its body shows a partial partitioning into an anterior and a posterior part. At the fixed end are some processes by which, when young, the animal can cling to the intestinal wall of the cockroach. Here it lies bathed in food material which diffuses through the cuticle.

*Gregarina blattarum* multiplies by conjugation, followed by spore production.

The various stages in the process may be tabulated thus:—

(1) Two Gregarines come together without fusing, and a cyst is formed round them.

(2) Their living matter breaks up into many tiny pieces called spores, each surrounded by a protective coat.

(3) The spores set free by the rupture of the cyst reach the outside in the excrement of the cockroach, and they lie protected by their resistant coat until swallowed by a feeding cockroach. In the alimentary canal of the cockroach the coat of the spore ruptures, and the droplet of living matter works its way into the cells lining the cockroach's intestine. Here, after some development, the worm-like shape is attained, and the parasite makes its way out into the intestine, to remain fixed for a time by one end, but later to cease its attachment and live freely in the cavity.

In an allied form that is found in the seminal vesicles of the earthworm, there is a slight difference in development, as each spore gives rise inside its wall to several sickle-shaped bodies, each of which is a young form capable of development into an adult on reaching the proper position in another earthworm.

In both of these cases a very large number of spores may be produced in accordance with the risks of the life-history: the spores have to leave the first host to prevent the number of parasites in it from being excessive.

Order *Coccidiidea.*—The species here, rounded or oval in form, are parasitic within cells, chiefly within epithelial cells. The infection of the host is generally by way of the mouth, to the alimentary canal, hence the parasites are commonest in the cells lining the intestine, and in the lining epithelium of neighbouring glands like the liver. The parasites, however, may pass through the wall of the intestine, and, reaching the blood, may be carried to some more distant organ.

The Coccidia are parasitic upon Molluscs, Insects, and Centipedes among Invertebrates, and upon all of the Vertebrate groups —*e.g.*, on the domestic fowl, the pigeon, the dog, the ox, and also on man.

In the case of the life-history of the Gregarine, we found that on becoming full-grown the parasite, after conjugation, gave rise to a number of spores which left the host. In the case of typical Coccidia, however, it is to be noted that their mode of multiplication is not limited to spore production. The parasite having developed at the expense of the cell in which it has been living, and having killed the cell, proceeds to multiply by fission. Its protoplasm directly splits into numerous pieces called mero-

zoites, which, getting free, attack each a hitherto healthy cell, accomplishing its death and its own growth to a mature Coccidium at the same time. By this mode of multiplication, the spread of the disease, in the same host, may be very great, and great harm results to the host.

After a certain number of cycles of multiplication by fission, the Coccidium, unable longer to multiply vegetatively, proceeds to a sexual multiplication, followed by the formation of spores: by means of these spores the parasite not only reinvigorates its own life, but is enabled to reach and infect new hosts. This mode of sexual multiplication is well illustrated in the life-history of *Coccidium schubergi*, parasitic in the intestine of the centipede, *Lithobius forficatus*.

The life-history of this Coccidium has been fully worked out by Schaudinn, to whose researches on Coccidia much of our knowledge is due. Schaudinn is quoted by Professor Minchin in his excellent review of the Sporozoa in Part I. of the 'Treatise on Zoology' edited by Ray Lankester. When reproduction takes place sexually, the tiny pieces of protoplasm,—named above the merozoites,—after having invaded a cell, do not grow so rapidly as is the case where multiplication by fission follows, but they increase in size slowly, ultimately becoming the mother-cells of structures that unite in an act of fertilisation. These mother-cells are known technically as gametocytes, and their products as gametes. There are two kinds of gametocytes; one kind—with denser and finely granulated protoplasm, and poor in reserve matter—divides up to give rise to a number of delicate microgametes, each of which is able to move about by means of two projecting flagella or whips. A second kind of mother-cell—bean-shaped when young, round when mature, and containing much reserve—gives rise to only one macrogamete. After the expulsion from the macrogamete of a specialised piece of protoplasm of its nucleus, known as the karyosome, the macrogamete is fertilised by one of the flagellate microgametes. A thick wall is formed round the macrogamete after the entry of the microgamete. The further development of this fertilised wall-protected body, now known as the zygote, may take place inside or outside the host. The different stages following fertilisation may be tabulated thus:—

(1) The nucleus of the zygote divides, and the division is repeated, so that four nuclei appear.

(2) Each gets surrounded with an aggregation of protoplasm and with two coats, resulting in a body termed a spore.

(3) Each of the four spores by another division forms two sporozoites, which are small sickle-shaped bodies, each one of which is capable, on gaining entry to an epithelial cell of a host, of developing into an adult Coccidium.

A healthy centipede is believed to become infected by swallowing one of the cysts that have formed after fertilisation; the digestive juices dissolve the protecting wall, and the sporozoites set free invade the epithelial cells of the intestine of the centipede.

A well-known *Coccidium* is *C. oviforme* of the rabbit's liver, which causes a swelling of this organ and yellow-white patches. There are also others, infesting the alimentary canal of rabbit, poultry, dog, cat, cattle. There are records from Switzerland of dysentery in cattle caused by Coccidia. Infestation is believed to take place in food or drinking-water, the disease spreading in a pasture from one animal to another. The parasite in this case lodges in the lining membrane of the intestine, and sets up inflammation. The disease has been produced experimentally. The symptoms are, rise of temperature, weakness—so that the animals persist in lying down—fæces mixed with blood coagula, loss of appetite, great thirst, frequent defecation. The Coccidia are found on examination of the fæces.

Order *Hæmosporidia.*—The members of this Order are typically parasitic in the red blood corpuscles of their host or in the cells of the spleen and bone marrow. They live within the corpuscle or cell attacked, completing their feeding and growth in it, as in the case of the malarial parasite; or they may leave the attacked cell before being full grown and invade another to complete their growth in it, or they may invade even a third, as in the forms parasitic in the frog and fish.

In the life-history there are two stages—the feeding and growing stage, and the stage of multiplication. The mode of multiplication is twofold—namely, a vegetative mode and a sexual mode. In the vegetative mode the grown parasite splits into pieces, any one of which invading another blood corpuscle can develop in it; this increases the infestation in the same host. The sexual stage of the life-cycle may, in cold-blooded hosts, take place in the same host, but in warm-blooded hosts the sexual stages are passed in an intermediate host, by whose agency the disease is communicated to the host whose blood corpuscles afford the feeding-ground for the parasite. For example, the parasite of malaria in man has its sexual stages in a mosquito—the mosquito being also parasitised—and after development in the mosquito the sporozoites are introduced to man's blood when this insect punctures him. In the case of birds the intermediate host is a gnat (Culex), in which the sexual stages in the life-cycle of the parasite are passed, and the sporozoites, when ready, are introduced into the blood of the bird when the wound is made by the gnat's piercing mouth parts. In Texas fever of cattle a tick acts as the intermediate host.

The parasites of the Order Hæmosporidia are confined to Vertebrate hosts. A few are known in fishes, *e.g.*, the sole; some in amphibia, *e.g.*, the frog; a number in reptiles, *e.g.*, the tortoise, crocodile, python, lizard. In these cold-blooded hosts, as far as is known, no serious results follow their attack. Many are known in birds and mammals, and the hosts here may suffer much from the infestation, death often following the fever induced by the parasite.

### *Malaria in Man.*

There are several kinds of malaria, which will be distinguished presently. Fig. 45, taken from Professor Minchin's review of the Sporozoa in a 'Treatise of Zoology,' is a scheme in diagrammatic form of the life-history of the parasite which causes pernicious or malignant malaria in man. The parasites of the other forms of malaria have a practically corresponding life-history.

The parasite—known in its earliest stage as a sporozoite, a tiny thread-like piece of protoplasm with a specialised part termed its nucleus—having gained entry to a red blood corpuscle, becomes rounded, and is capable of movements due to the extension or protrusion of processes of its protoplasm. Examined as the hours pass, it is found to grow at the expense of the corpuscle; the hæmoglobin or pigment of the corpuscle is converted into a black material known as melanin, and this collects in granules round the nucleus of the parasite. Having attained its full size, in a period varying from twenty-four to forty-eight hours, the parasite proceeds to multiply itself by fission or schizogony. Its nucleus divides into a number of pieces, and the protoplasm does the same. Each daughter nucleus becoming surrounded with protoplasm, we have now a number of small bodies, each known as a merozoite. These merozoites, by the breaking down of the destroyed blood corpuscle, are set free in the blood, and those that escape being devoured by the white blood corpuscles, invade each a hitherto unattacked red blood corpuscle, and in it proceed to complete their growth. The completion of growth is followed again by fission. As this whole cycle of the life-history can be completed in forty-eight hours, it is easy to understand the great destruction of blood corpuscles that can result, with all the detriment that this means to the health of the patient. This part of the life's-cycle is shown in the upper part of fig. 45. In this figure, 1 represents a greatly magnified drawing of a red blood corpuscle with a parasite inside it. Following the figures to 5, we notice the gradual growth of the parasite. No. 6 shows the mature parasite, which in 7 is beginning to divide up; in 9 division

is complete, and the merozoites have escaped from the infested corpuscle: any one of these may invade a new corpuscle. The letter *n* represents the nucleus, and *p* the granules of melanin.

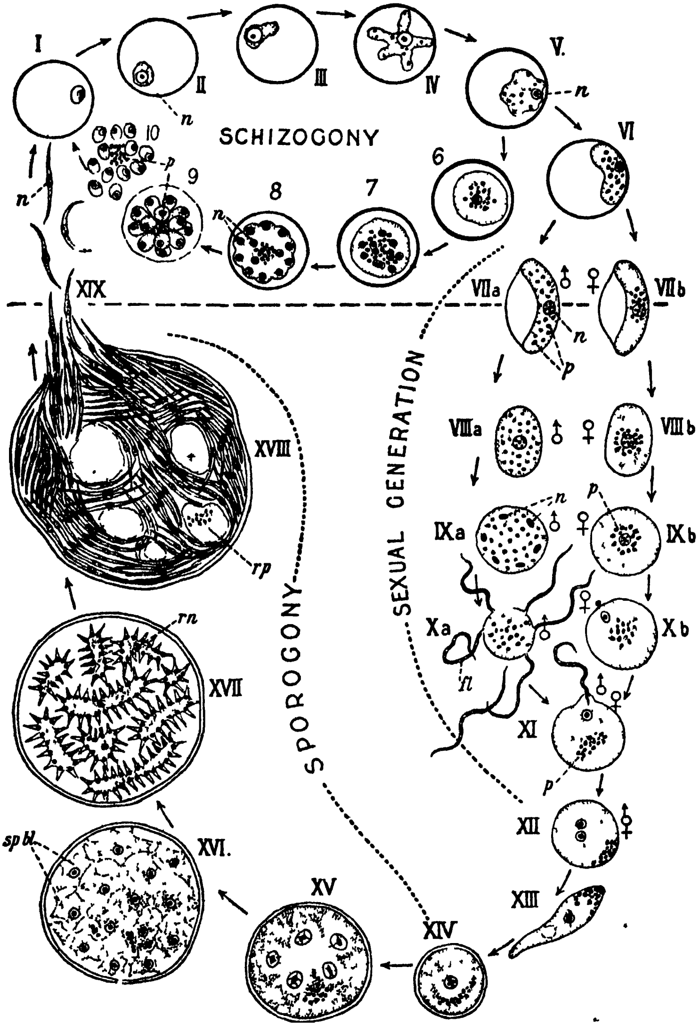



Fig 45 —Life history of the parasite of pernicious malaria (From 'A Treatise on Zoology' Edited by E. Ray Lankester. Part I )

So far all these changes have taken place in the same host, man, in whom the development has been entirely vegetative or non-sexual. But this is only one cycle in the life-history of the parasite. A second cycle of change and development—the

sexual cycle—is passed external to man and in the body of a mosquito. This cycle now falls to be described.

In other forms of malaria, the bodies that will, in the course of development, give rise to the male and female sexual elements, resemble in shape the parasite with its growth completed and about to divide by fission, as described above; but, in the case of the parasite of pernicious malaria, the bodies which begin the sexual cycle are crescentic in shape, and are known as "crescents." Swallowed by a mosquito which has taken up the blood of a malarial patient, these crescents behave in one of two ways:—

1. Some of them — the male crescents — after becoming rounded, show, projecting from their surface, thread-like structures capable of an active movement. These structures—called microgametes—break away, leaving behind pigment particles with some remaining protoplasm.

2. Others of the crescents change also to a rounded shape, but remain passive, each forming what is known as a macrogamete. In the mosquito stomach the microgametes, breaking away, move towards a macrogamete; and one enters, and the nuclei of the two bodies fuse—that is, fertilisation is effected. After the entry of the microgamete, the other changes its shape, becoming elongated and worm-like: it is also able to move. In its movements it penetrates the wall of the mosquito stomach, and takes up its lodgment between the inner and outer coats of the stomach, where, in some thirty-six hours after the mosquito has fed, it may be found. It continues to grow, until, in severe infestation, the mosquito's stomach may be covered with little swellings. The nucleus of the fertilised macrogamete, now known as the zygote, divides repeatedly, and each daughter nucleus gets surrounded with protoplasm, until at last the cyst encloses a large number of sporozoites. When the cyst ruptures the sporozoites are discharged into the body-cavity of the mosquito, whence, by the blood-stream, they are carried to its salivary glands. These salivary glands are in connection, by a duct, with the mosquito's proboscis; and when the mosquito bites a man, the sporozoites are injected along with some saliva into the man's blood. The sporozoites invade the blood corpuscles, and the life-history of the parasite begins anew.

The second or sexual cycle in the life-history is illustrated in the lower part of fig. 45; fig. VI. shows the parasite at the beginning of the sexual changes; VII. *a* is the male crescent, VII. *b* the female crescent; VIII. *a* and *b* and IX. *a* and *b* show the change to the oval shape and then to the round shape; X. *a* the formation of the male gametes; X. *b* the female gamete; XI. the act of fertilisation; XII. the two nuclei near one another; XIII.

the zygote—the result of fertilisation—become worm-shaped; XIV. the zygote encysted; XV. the nucleus has started to divide; XVI. division further advanced; XVII. the beginning of formation of the sporozoites; XVIII. the sporozoites ripe and escaping from the cyst, each on the way to infect a red blood corpuscle.

An interesting and rather puzzling phase in malaria is the latent phase. The parasite may disappear from the general circulation, and the patient may seem to have recovered; but after a time the parasite reappears, with the renewal of the old symptoms. Where the latent stage is passed, or in what form, was unknown till recently. Schaudinn has suggested that in the case of this relapse without any further infection, the parasites causing the new attack have arisen from resistant forms that normally would have given rise to female gametes. These have persisted, and at last have parthenogenetically—that is, without fertilisation—given rise to merozoites, which begin the life-cycle anew in the patients. What actually calls these resistant forms into activity is not known; probably a lowered vitality of the patient induces the conditions.

### *Different kinds of Malaria.*

Several species of parasite are recognised as causing different types of malaria in man. Some would make more than three species, breaking our third species up into still further varieties; but for our purpose, to regard the kinds as three in number will be sufficient. The three may be distinguished thus:—

| *Plasmodium vivax* (Gr. et Fel.) | *Plasmodium malariæ* (Lav.) | *Plasmodium immaculatum* (Gr. et Fel.) |
|---|---|---|
| Benign tertian parasite. | Benign quartan parasite. | Pernicious or malignant parasite. |
| Life-cycle of a generation in man lasts 48 hours, causing a fever or paroxysm every 2 days. The paroxysm corresponds to the fission and the escape of the merozoites from the corpuscle into the blood. | Life-cycle of a generation in man lasts 72 hours, causing a fever or paroxysm every 3 days. | Life-cycle of a generation in man irregular, lasting from 24 to 48 hours. |
| The parasite takes up the whole red blood corpuscle. | The parasite takes up nearly the whole corpuscle. | The parasite is smaller, taking up only a part of the corpuscle, but it is very destructive. |

| *Plasmodium vivax* (Gr. et Fel.)—*cont.* | *Plasmodium malariæ* (Lav.)—*cont.* | *Plasmodium immaculatum* (Gr. et Fel.)—*cont.* |
|---|---|---|
| The amœboid movement of the parasite in its younger stages most active; the parasites can be seen protruding their pseudopodia (processes of protoplasm). The movements, too, continue longer than in the others. | The movement of the parasite is slight. | The parasite shows active amœboid movements in its young state. |
| The attacked corpuscles swell and become very pale in colour. | The attacked corpuscles may diminish in size but retain their normal colour. | The attacked corpuscles shrink in size, and may become darker or paler. |
| The cycle in man can be followed through all its stages, as these can be traced in the peripheral or general circulation. | The cycle in man can be followed through all its stages, as these can be traced in the peripheral or general circulation. | The complete cycle in man is difficult to trace, as the later stages take place in internal organs—*e.g.*, the spleen. |
| The gamete is never a crescent, but a sphere or disc. | The gamete is never a crescent, but a sphere or disc. | The gamete is a crescent. |

It has been previously stated that Hæmosporidia were well known in birds. The life-histories of some of them have been thoroughly worked out. One, infesting some common birds, has the two cycles in its life-history—namely, the vegetative or non-sexual cycle in the bird, and the sexual cycle in an intermediate host. The intermediate host in the case of this bird parasite is also a mosquito, but of the genus Culex. The species of the genus Culex cannot act as the intermediate host to the parasite of malaria in man; indeed, if a Culex puncture a malarial man, the parasite swallowed, in any of its stages, is digested. The intermediate host of the parasite of man is a mosquito of the genus Anopheles (the word is Greek, and means hurtful). Of the part played by Culex in the case of the bird, and that played by Anopheles in the case of man, there can be no doubt. Ross, working with the disease in birds, fed mosquitoes on diseased sparrows, and then placed these mosquitoes on twenty-eight healthy sparrows, producing the disease in twenty-two. In Italy a healthy man allowed himself to be bitten by an Anopheles fed on a malarial patient, and as a result became infected. Bignami and Grassi confirmed this with other experiments. Again, mosquitoes fed in Rome on malarial patients were conveyed under cover to England. Two gentlemen offered themselves for experiment, and the mosquitoes were

allowed to bite them. Soon afterwards both, although never at any time previously exposed to malarial influences, developed malarial fever, and the parasites were obtained in great numbers from their blood. Besides, under Manson's supervision, several persons (two of them doctors) lived for three months in one of the worst malarial districts in the Roman Campagna without acquiring the disease. These persons were at liberty to move about freely in the open during the day, living the life of the place, but they passed the time from sunset to sunrise in a hut rendered mosquito-proof by gauze. The neighbours of these persons, without the protection against mosquitoes, suffered from malaria.

There are some who still cling to the old theories of infection from the soil and from drinking-water. Celli and other Italian workers, working with the disease on birds, made numerous attempts to set up infection by inoculating the birds with earth of the most malarial places; but in spite of repeated experiments, and most careful microscopic examinations, they met with no success. Nor has any success attended attempts to induce the disease in experiments where marshy waters were used. The relation of water to mosquito development will be discussed presently. So far proof fails that malaria can be carried in any other way than by a mosquito. The mosquito theory was definitely formulated only some ten years ago; yet there are references in the old books of the times of the Romans to the possible agency of insects, and sporadic references in the literature of the seventeenth century and onwards; again, the native word *mbù* in East Africa stands both for mosquito and malaria. Verily, "the thing that hath been, it is that which shall be; and there is no new thing under the sun."

The conclusions regarding malaria may be fitly summed up in Celli's axioms as stated in Eyre's translation of Celli's 'Malaria':—

1. The hours during which the malarial germs are most plentiful in the air are those of the evening, sunset, and night.

2. They generally rise from limited foci, and are diffused to a limited distance in the horizontal, oblique, and vertical directions.

3. The winds, properly called, do not generally transport them—they tend rather to diminish their number in the atmosphere. Light winds may sometimes cause the diffusion of malaria.

4. Woods, instead of filtering, may be the foci of malarial infection.

5. By day mosquitoes live hidden and sheltered, while they come out to bite man in the evening and night.

6. Mosquitoes do not wander far from the place where they

have bred out, and especially they do not fly high from the ground.

7. When the wind blows they do not, as a rule, come out of their shelter-places.

8. Shady and damp woods, and trees in general (some shelter willingly under cover in houses), are the shelter-places for mosquitoes.

9. The mosquito is the source and the carrier of malarial infection.

In relation to the mosquito as a carrier, one is sometimes asked, "Have we any Anopheles species in England?" The answer is, "Yes." Amongst those in England are species which, abroad, have been proved beyond all question to act as the intermediate host. The complete, or almost complete, absence of malaria in England to-day compared with the agues of past times, which reasonable evidence shows to have been malaria, is somewhat puzzling. Drs Nuttall and Cobbett and Mr T. Strangeways-Pigg have studied very carefully this subject, and in a communication to the 'Journal of Science,' vol. i., 1901, on "The Geographical distribution of Anopheles in relation to the former distribution of Ague in England," the authors conclude that—

"1. The disappearance of ague from Great Britain does not depend upon the extinction of mosquitoes capable of harbouring the parasites of malaria.

"2. Three species of Anopheles (*A. maculipennis*, *A. bifurcatus*, *A. nigripes*) are to be found in Great Britain in all districts which were formerly malarious, but also in places concerning which there is no record of the former prevalence of ague.

"3. The Anopheles to-day are most numerous in low-lying land containing many ditches, ponds, and slowly-flowing water suitable for their habitat, and corresponding to the districts where ague was formerly prevalent.

"4. Since the disappearance of ague does not depend upon the extinction of Anopheles, it is probably due to several causes operating together, namely—

"(*a*) A reduction in the number of these insects consequent upon drainage of the land, this being in accord with all the older authors who attributed the disappearance of ague largely to this cause.

"(*b*) Reduction of the population in infected districts, as the result of emigration about the time when ague disappeared from England. This would naturally reduce the number of infected individuals, and thus lessen the chance of the Anopheles becoming infected.

"(*c*) It is possible that the use of quinine has reduced the chances of infecting the Anopheles, through checking the

development of the parasites in the blood of subjects affected with ague.

"5. Since the geographical distribution of Anopheles in England is wider than the former distribution of ague in this country, it is not a matter of the geographical distribution of Anopheles as much as of their numerical distribution.

"6. In the occasional occurrence of ague in out-of-the-way places, it is not necessary to assume that malaria-bearing mosquitoes have been freshly imported; for given suitable conditions of temperature, and the requisite number of Anopheles, a malarious subject coming from other parts might well infect the local insects, which, in turn, would spread the infection to healthy persons."

In view of these conclusions, it is interesting to compare the view of Schaudinn and Grassi that in some cases the Anopheles become naturally immune against the parasite of malaria. They would thus explain the absence of malaria in England, from places where once it was common, to all the mosquitoes having acquired immunity.

### *What is a Mosquito?*

There are two related families of Dipterous insects, both of which are known as gnats—namely, the Mosquitoes (Culicidæ) and the Midges (Chironomidæ). Mosquitoes and Midges may be distinguished thus:—

| *Mosquitoes.* | *Midges.* |
|---|---|
| Head has a long projecting proboscis | The proboscis not projecting. |
| The front pair of legs shorter. | The front pair of legs longer. |
| The insects rest with their hind pair of legs held up. | The insects rest with their front pair of legs held up, and these may be used as feelers. |

We have here only to do with the Mosquitoes or Culicidæ.

Theobald, who has recently published a monograph of the Culicidæ, divides them up into five sub-families. Two of the sub-families are the Anophelina and the Culicina. The first includes the genus Anopheles, some species of which act as the carriers of the parasite of malaria in man; and the second includes the genus Culex, species of which act as the intermediate host of the disease in birds, and also the genus Stegomyia, a foreign species of which—viz., *Stegomyia fasciata*—has been quite recently named as the cause of the spread of yellow fever.

The larvæ of the Culicidæ are all aquatic.

The genus Anopheles is distinguished from the genus Culex by the following characters:—

| *Anopheles.* | *Culex.* |
| --- | --- |
| The insects when at rest stand with their body at an angle to the surface on which they are resting. | The insects when at rest stand with their body parallel to the surface on which they are resting. |
| Palpi (appendages to the proboscis) are as long as the proboscis. The male has the end joint of the palpi clubbed | Palpi in the female much shorter than the proboscis. In the male the palpi are almost the length of the proboscis. |
| Eggs float not attached together in numbers. | Eggs float attached together in numbers, making a boat. |
| The larvæ lie horizontally in the water. | The larvæ hang head downwards in the water, partly owing to their larger heavier head. |
| The spiracles of the larva open directly on the back of the eighth segment, there being no respiratory tube. | The spiracles are at the end of a respiratory tube, which keeps the larva suspended from the surface film. |
| Larva is mainly a surface feeder. | Larva goes oftener to the bottom for feeding |

## *Life-history of Anopheles.*

Several observers have worked out the life-history of different Anopheles and Culices. Nuttall and Shipley have carefully traced the life-history of *Anopheles maculipennis.*

The eggs are laid by the females, preferably in water of pools, canals, and ditches containing food material in the shape of Algæ, the larvæ being feeders on vegetable matter. The eggs float, and the maggots, on hatching, drop out at the blunt end into the water. The larva is a surface feeder typically. Hanging to the surface film, the openings of the tracheæ or breathing tubes on the back of segment eight, near the end of the abdomen, are exposed to the air. If the larva be disturbed those breathing pores or stigmata can be covered over and the larva can go to the bottom, partly sinking by its own weight and partly by swimming downwards. When full grown the larva passes into the pupal stage, a stage in which the pupa is capable of active movement, but no feeding is done. From the head end project two respiratory tubes or trumpets, and the pupa floats so that these are enabled to pierce the surface of the water. Air is taken in at their ends and then passed along two main tracheæ. When disturbed or alarmed the pupa can, by active wriggling, pass down into the water, but when wriggling ceases the pupa's buoyancy brings it to the surface. When the

pupal stage is completed, the fly emerges by a slit in the pupal skin; and this is a dangerous period for the emerging fly, for if it falls into the water it is drowned. In addition to this danger, there is a certain mortality in connection with flies that fail to properly free themselves from the pupal skin. The insects that safely emerge, rest until their wings and legs have dried and hardened, when they fly away.

### *Male and Female Anopheles.*

An easy naked-eye distinction is the difference in the antennæ of the two sexes, those of the male being markedly feathery and handsomer. The males feed on fruit and plant juices; the females take blood when they can get it, and they are greedy and persistent in their attack. The wound is made by a mouth apparatus of piercing stylets and cutting blades. The female having gorged herself on a blood diet, rests for a time and then proceeds to egg-laying. Feeding and egg-laying can be repeated by the same individual.

### *Treatment for Malaria.*

1 *As against the parasite in the blood*—Nothing is so effective in this connection as quinine, which, persisted in, is a cure, alleviating to begin with, and eliminating the disease at last. Unfortunately quinine does not seem to prevail against the "crescents."

2. *As against the adult mosquito.*

(*a*) Do not sleep in the open air.

(*b*) Remember that the time for the mosquitoes' activity is between sunset and sunrise, and avoid exposure as much as possible between these times.

(*c*) The careful use of mosquito net.

(*d*) Protecting windows and doors by a wire-gauze network, sufficiently fine in mesh to exclude the mosquitoes.

(*e*) Fumigation of rooms and bedrooms by burning sulphur or fresh pyrethrum powder. Celli recommends, as the result of experiment, a powder of larvicide (one of the aniline dyes supplied by Weiler-ter-Meer of Uerdingen), powdered pyrethrum, and root of valerian. One to two tablespoonfuls of this mixed powder, burned in a room, stupefied all the mosquitoes till morning, and larger quantities when burned, killed the mosquitoes. Powdered pyrethrum, however, is excellent by itself.

(*f*) The use of washes or pomades, with odours disagreeable to the mosquito.
(*g*) Careful and repeated inspection of all likely places that might be used for egg-laying purposes by the adult mosquito—*e.g.*, cisterns, tubs, wells, &c.
(*h*) Destroy breeding-places by filling up holes, draining swamps, disinfecting puddles, &c.
(*i*) The clearing away of all disused vessels that might serve to hold water—*e.g.*, old cans, biscuit-boxes, &c.
(*k*) Examination of the house during the day, with the killing of any mosquitoes found.

3. *As against the larva of the mosquito.*—A number of different materials, mineral and vegetable, are efficient against the larva, but many are too expensive to use on a large scale. Certain aniline dyes are serviceable; present in the water they kill the larvæ, and yet are non-hurtful to stock. Oil—paraffin or crude petroleum—if arranged so as to form a film over the surface of the water, is rapidly fatal to the larvæ; the larvæ are suffocated.

### *Texas Cattle-Fever.*

While it is by no means certain, and, indeed, is perhaps unlikely, that all or most of the Hæmosporidia have an intermediate host in the shape of some blood-sucking animal, there is no doubt whatever that the parasite of Texas fever is carried by a tick.

Texas cattle-fever is a disease of the blood, the symptoms attending attack being anæmia, due to the great destruction of red blood corpuscles, and accompanying derangement of the organs whose function it is to remove waste matter and other products from the blood. Both in the urine and in the bile there may be an excessive amount of colouring matter. The disease has been the cause of great loss in the United States, Australia, and various tracts of South Africa.

### *Life of a Tick.*

In order to understand clearly the very interesting part played by the tick in its relation to the parasite of Texas cattle-fever, a general knowledge of a tick's life-history is necessary.

In the life-history of the true ticks—that is to say, of the Ixodidæ—there is a metamorphosis with four stages—adult, egg, larva, nymph. The larva, when it hatches from the egg, applies itself to reach a host. The newly-hatched larvæ are tiny creatures with six legs; they ascend blades of grass, and wait until a host comes along. The passing host is clutched

with outstretched forelegs, and the larval ticks having gained a lodgment, fix themselves by their rostrum and proceed to feed on the blood of the host. After feeding for some time the larva drops away, and remains passive on the ground until it has completed a first moult; on the rupture of the skin the nymph appears; it has longer and stronger legs and an additional pair of legs. This nymph, however, is not adult, and, like the larva which preceded it, it also seeks a host, and having found one, attaches itself and feeds. After a time the nymph, too, falls to the ground and moults; the adult stage—male or female—is now attained. These adult ticks, having in their turn attached themselves to a host, pair, and the fertilised females, having gorged themselves with blood, leave go, fall away, and proceed to egg-laying. Each egg contains, in addition to the germ of the future tick, a supply of nourishing matter for the use of the developing embryo: it is in order to provide this nutrient reserve that the female gorges herself with blood.

*Life-history of the Parasite of Texas Cattle-Fever.*

The Sporozoon parasite is named *Piroplasma bigeminum* from its being pear-shaped, and from its mode of dividing into two resembling bodies. It is very small. The stages in the life-history can be followed in fig. 46. The blood parasite, having invaded a red blood corpuscle, nourishes itself at the expense of the corpuscle and grows. Its nucleus then divides into two, and this nuclear division is followed by a division into two of the protoplasm of the parasite: the young parasites show as pear-shaped bodies. In the case of malaria of man, it will be remembered that the parasite having attained its full size in the blood corpuscle, divided up into a number of portions, but here division is into two.

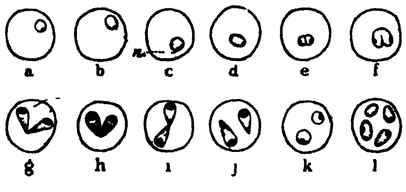



Fig. 46.—Development of fission of *P. bigeminum* in blood corpuscle of ox. (From 'A Treatise on Zoology.' Edited by E. Ray Lankester. Part I.)

A tick known as *Boophilus bovis* or *Rhipicephalus annulatus* plays the part of carrier. It is probable that the changes which the parasite undergoes in the tick resemble what we saw took place in the mosquito, but so far the changes have not been observed or followed. An adult female tick, full of blood containing the parasites, drops away from the infected ox and lays her eggs, which are extremely numerous. The embryo develops in the egg, and up to the period of hatching is nourished at the

expense of the reserve of blood stored in the egg for it by the parent. This blood contains the Piroplasma parasites, and thus the larval tick, on hatching from the egg, already harbours them. On reaching a host—another ox—the tick makes a wound with its piercing rostrum, and in so doing introduces the parasites to the blood of the ox. When healthy cattle were put to graze on fields that had been infected—that is, on fields where affected animals had pastured a considerable time—between one and two months were found to elapse before the disease revealed itself on the new-comers. The length of the time elapsing before infection showed was at first puzzling. The explanation, however, is, that a month of this time is taken up with the development of the embryo tick in the egg and its hatching into the larval form preparatory to its reaching an ox (fig. 47). The mode of infection and the part played by the tick were enunciated by Smith and Kilborne, and their re-

Fig. 47.—Animal dead from Texas fever, froth issuing from nostrils (From Report by Gray and Robertson on Texas Fever in Rhodesia, August 1902.)

searches have afforded the key for the solution of similar parasitic problems. Other Piroplasma species have been described—one from the horse, one from the sheep, and one from the dog.

### *Other Orders of Sporozoa.*

Two remaining Orders of the Sporozoa may be named here for completeness—viz., the Myxosporidia and the Sarcosporidia. In both of them the parasite does not postpone its reproduction until it has completed its feeding and growth, but growth and reproduction go on at the same time. Among the Myxosporidia are some well-known parasites on fish, and one is regarded by some as the cause of the "pebrine" disease in the caterpillars of the silkworm moth, a disease which occasioned very great loss in France in connection with the silk industry. The parasite of the caterpillars is known as *Glugea bombycis*, and affords an extremely interesting example of hereditary infection. The

spores of the parasite may develop in the eggs of the moth, and when the caterpillar hatches it may already be infected, and be capable of passing on the infection to others. Other non-infected caterpillars may become infected by swallowing the spores during their feeding.

### *Yellow Fever.*

This disease is restricted to a comparatively limited area. The West Indies are its centre, and in various directions from the West Indies we get outbreaks or epidemics in the south and south-west United States, in Central America, and the north parts of South America. There have been sporadic outbreaks in South Europe, and cases even in England, but the disease cannot gain a lodgment in Europe, as a high temperature—not lower than 75° F.—is necessary. Yellow fever is worst near the coast, and in rainy places, or during rainy seasons. Typically it is worst in the crowded insanitary conditions likely to be present in some seaport towns.

Various theories have been advanced to account for yellow fever, and more than once claims have been put forward of different bacterial parasites having been discovered, isolated, and proved to be the cause of the disease. Several of these bacteria, indeed, have been named and experimented with, but no body of satisfactory experimental evidence is behind those claims made. It has also been suggested that the disease, instead of being due to a blood parasite, is due to an organic toxin present in the saliva of the mosquito named *Stegomyia fasciata.*

The parasite has so far not yet been determined; it seems that, like some other very injurious forms, it is so small as to escape the search of the most accomplished microscopists. Reasoning from analogy, however, and in view of striking features as regards incubation and infection periods, opinion has leaned strongly to the view that the parasite, like that of malaria, is a Protozoon one. Satisfactory evidence is forthcoming that the parasite is spread by an intermediate host, and that another mosquito—viz., *Stegomyia fasciata.* This mosquito is one of the family Culicidæ, like Anopheles and Culex, but it is nearer to the genus Culex than to Anopheles. The life-history of Stegomyia resembles that of the other Culicidæ, the eggs being laid in water, and the larva being aquatic. This Stegomyia, however, seems to fly in the hotter hours of the day.

In connection with yellow fever, it is known that although the patient suffers from the fever nearly always within four or five days of being infected, yet, on such a patient giving rise to the spread of the disease, or to an epidemic, no new case is reported until at least twelve or so days have elapsed. The explanation

is that during these days the parasite, swallowed by a Stegomyia which had wounded a yellow-fever patient and had drunk his blood, has been developing in the mosquito, and that ten or twelve days are required before the parasite is ready for successful inoculation into a human host. A Stegomyia once infected from a yellow-fever patient is capable of communicating the disease for a period of about two months without having itself received any new infection. Interesting also is the fact that a patient is only dangerous during three or four days of the disease—that is, the parasites, in whatever form they may then be in his blood, are after this time no longer capable of developing in Stegomyia. With the belief in the Stegomyia as the intermediate host in yellow fever, attention is being directed to the destruction of this mosquito. Havanna is a place where yellow fever has for long been endemic and often a scourge, and yet writing to the 'Lancet' of August 9, 1902, Sir W. R. Rynsey is able to say: "During the past year Havanna has been freed from the scourge by killing the mosquitoes in the neighbourhood of each focus of disease as discovered, and by carefully disinfecting every house that had lodged a yellow-fever patient, in order to destroy the mosquitoes that had bitten a sick person."

### *Trypanosomiasis.*

So far the disease-causing Protozoa that have been mentioned have all been species belonging to the group Sporozoa. There remain to be noted the Trypanosomes, which belong to the group Flagellata, and are parasites in the blood and cerebro-spinal fluid of various hosts. The Flagellata are active Protozoa characterised by the possession of a flagellum (there may be more than one), a whip-like process of vibratile protoplasm used in locomotion. Most of them live in the midst of putrefying organic matter, but some are parasites. A Trypanosome measures on the average about $\frac{1}{1000}$ of an inch in length. The general shape and appearance of a Trypanosome will be seen by a reference to figures 48 and 49, which are from preparations made by my colleague Professor Dunstan, to whose courtesy I owe the photographs from which these figures were made. Both figures show the Trypanosomes and blood corpuscles under a magnification of 1000. Fig. 48 is that of *T. Lewisi*, taken from the blood of a rat. Fig. 49 is *T. Gambiense*, from the blood of a guinea-pig.

A Trypanosome, magnified under the microscope, is a worm-like piece of protoplasm enclosed in a cuticle, with a wavy flagellum at one end and a more or less transparent "undulating membrane" attached to one side of the body; the "undulating

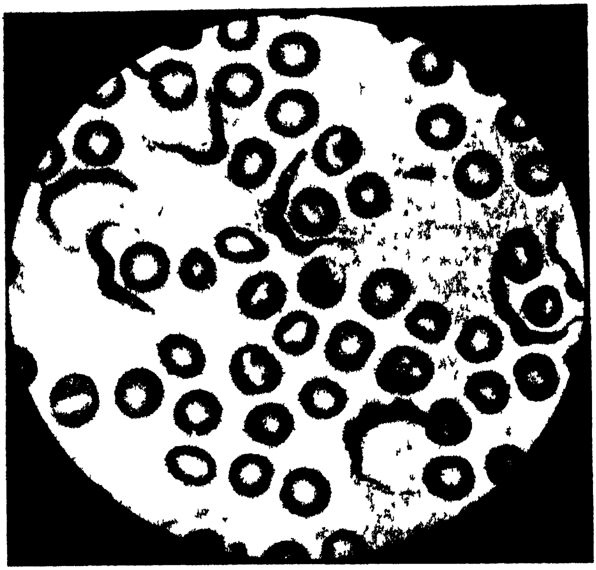


Fig 48 —Trypanosomes from blood of rat—×1000 The round bodies are blood corpuscles

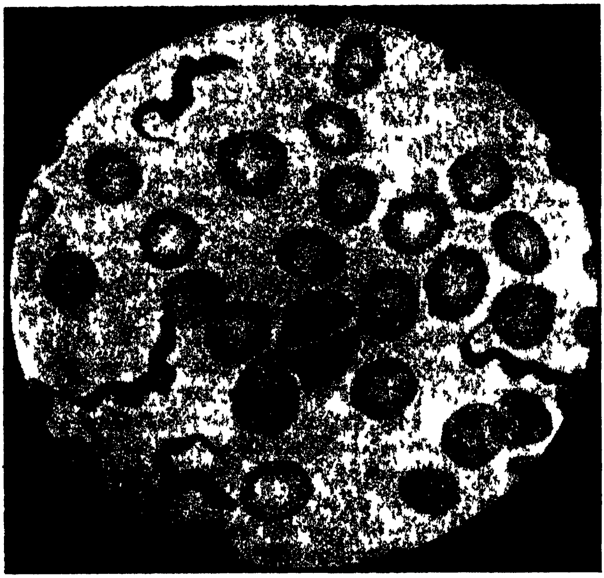


Fig 49.—Trypanosomes from blood of guinea-pig—×1000. The round bodies are blood corpuscles.

membrane" begins a little in front of the hind and blunter end of the Trypanosome and runs forwards into the flagellum. Very careful examination reveals in the protoplasm two bodies, one larger and about its middle called the macronucleus, and one smaller and towards the blunt end, known as the micrônucleus; at the blunt end too may be seen a vacuole. Movement of the organism is by the lashing flagellum or by the "undulating membrane" or by rhythmic contractions of general protoplasm. Plimmer and Rose Bradford, in minute examinations of the Trypanosome of tsetse-fly disease, found in their preparations other bodies in the blood differing in appearance from the typical form just described, and these they believe to be other stages in the life-history. For example, Trypanosomes were seen splitting longitudinally, this being one mode of multiplication; others were seen in conjugation, exchanging micronuclear matter; amœboid irregularly shaped protoplasmic bodies were also seen, sometimes with, sometimes without a flagellum; and still again, so-called plasmodial forms, probably aggregations of the amœboid forms. The full signii ance of these various forms, however, is not yet known; indeed as far as Trypanosomes in mammals are concerned, little or nothing has been definitely determined about their modes of multiplication and reproduction, save that longitudinal fission takes place. Recently, however, Danilewsky and Ziemann and Schaudinn, in their researches on Trypanosomes in birds, have demonstrated a sexual cycle like that described for malaria. One of the birds studied was the Little Owl, and it was found that *Culex pipiens*, one of our own common gnats, plays the part of intermediate host. Just as Anopheles does in the case of malaria and man, so *Culex pipiens* introduces into the blood of the punctured owl the young stage of the Trypanosome parasite, developed from the sexual stages that have been passed in the gnat.

Trypanosomes parasitic in the blood are not found inside the corpuscles; they live in the blood-stream. These parasites have been found in amphibians, reptiles, and birds, as well as in mammals. The study of Trypanosomiasis is a recent study, and, as far as Great Britain is concerned, much evidence and information has been accumulated by inquiries set on foot by the Royal Society of London and expeditions undertaken under the auspices of the Liverpool School of Tropical Medicine. The results in the latter case have been tabulated and issued in several handsome reports. Further research will clear up difficulties as to distinction of species and doubts that still exist as to questions of life-history, mode of harm, and so on.

A summary of species infesting man and some domesticated animals, with some notes on these, may prove useful to those

members of the society interested in Trypanosomes and their parasitism :—

| Name of parasite. | Natural host. |
|---|---|
| *Trypanosoma Gambiense*, or *Ugandense*, or *hominis* (Sleeping Sickness) | Man. |
| *T. Brucei* (Nagana) . . . | Horse and domesticated mammals. |
| *T. Evansi* (Surra) . | Horse and domesticated mammals. |
| *T. equiperdum* (Dourine) | Stallions, brood-mares, donkeys. |
| *T. equinum* (Mal-de-caderas) | Horse. |
| *T. Theileri* (Gall-sickness) | Cattle. |
| *T. Lewisi* . . . | Rat. |

While the disease can be set up experimentally by inoculation, it is believed that infection in nature is by means of some insect carrier of the parasite, save in the case of *T. equiperdum*, where infection takes place in coitus. In Sleeping Sickness one of the tsetse flies, *Glossina palpalis*, is specially blamed as carrying and inoculating; and for Nagana, another tsetse fly, *Glossina morsitans*, is blamed; and perhaps *Glossina pallipides*, a larger species, may also act as a carrier of Nagana. In Surra, Tabanidæ or gadflies are blamed; in Mal-de-caderas a Stomoxys; in Gall-sickness a Hippobosca; and in *T. Lewisi*, which is non-pathogenic, the rat flea.

The earliest mention of Trypanosomes in the literature is that of Gruby's discovery of one in the blood of the frog. This Trypanosome was noted again in 1871. In 1878 Dr Lewis, working in India, found and described a Trypanosome in the blood of the rat; and later the same Trypanosome was plentifully found in the blood of rats in England. Although this Trypanosome may be present in numbers in the rat's blood, it does no harm. When it was experimentally injected into rabbits and guinea-pigs the Trypanosomes were destroyed by the white blood corpuscles or phagocytes.

In 1880 the Trypanosome of Surra was discovered by Veterinary-Surgeon Evans in the blood of horses and camels, and at intervals since the others were made known.

## SLEEPING SICKNESS.

This disease, known for a long time, though first written of by Winterbottom in 1803, as producing a fatal lethargy in Africans, was, until 1901 or 1902, considered to be characteristic of, and confined to, districts of West Tropical Africa, from Senegal in the north, on by the islands of the Gulf of Guinea to Loanda in the south. Since 1902, however, Sleeping Sickness has been reported from East Africa, and in the British territory of Uganda thousands of the natives have perished of the disease. The disease is never at any great distance from water. In con-

nection with the Uganda outbreak a Commission was sent out by the Royal Society.

Both sexes are equally attacked, and all ages from childhood upwards. The disease is not contagious.

*Symptoms.*—Headache, moroseness, disinclination to work, and a desire to sit and remain resting. Later the facial expression changes to a vacant look, and this is accompanied by a puffiness and drooping of the lower lip. The tongue may show a tremor, and the hands also; and the hand-grip is weak. As the disease runs its course, the drowsiness and other symptoms are intensified. The patient, about the fourth to the sixth month, refuses to get up, has to be forced to take food, swellings and ulcerations show, and a state of complete lethargy terminates in death (fig. 50). It was thought for a long time, and is sometimes stated yet, that blacks only are attacked; but this is a mistake, as there are also records of infection of Europeans who have succumbed to the disease.

### *Cause of Sleeping Sickness.*

Various theories have been stated at different times in explanation of Sleeping Sickness:—

(*a*) That it was a form of sunstroke.

(*b*) That it was a variety of malaria.

(*c*) That it was a bacterial infection of the brain and spinal cord.

(*d*) That it was due to the poisonous or intoxicating properties of the manioc, a common food of the tropics obtained from the swollen roots of several plants.

(*e*) That it was due to parasite worms. Several worms are named. Manson leaned to the view that one of them, *Filaria perstans*, might be the cause, but inquiry has placed beyond doubt that this worm is not the cause. Although *F. perstans* may be present in Sleeping Sickness cases, yet its presence is a coincidence, there being areas where Sleeping Sickness exists and no *F. perstans*, and areas where *F perstans* is found and no Sleeping Sickness. The presence of *F. perstans* and other parasitic worms may be a predisposing cause, as impairing the strength and reducing the vitality of the patient.

The actual cause of Sleeping Sickness has been traced to a Trypanosome. Castellani had noticed a Trypanosoma in the brain and spinal cord of negroes who had died from Sleeping Sickness, but it was left to Bruce to work out the hypothesis, and to prove that the Trypanosome was the cause of the disease. This Bruce (Castellani working part of the time with him) did in 1903, and his conclusions, as stated in his report to the Royal Society, may be quoted:—

1. Sleeping Sickness is caused by the entrance into the blood and cerebro-spinal fluid of a species of Trypanosoma.

2. The species is probably that discovered by Forde, and

Fig 50 —Sleeping Sickness (From the Report of the Royal Society of London )

described by Dutton, from the West Coast of Africa, and called by Dutton *Trypanosoma Gambiense.*

3. The so-called cases of Trypanosoma fever, described from the West Coast, may be, and probably are, cases of Sleeping Sickness in the earliest stages (Drs Dutton, Todd, and Christy, in their Report on Human Trypanosomiasis on the Congo, agree with this, and also state that in nearly every case where

Sleeping Sickness was diagnosed or suspected, Trypanosomes were found either in the blood or the cerebro-spinal fluid, or both).

4. Monkeys are susceptible to Sleeping Sickness.

5. Dogs and cats are partially susceptible, but guinea-pigs, donkeys, oxen, goats, and sheep have shown themselves up to the present absolutely refractory.

6. The Trypanosomes are transmitted from the sick to the healthy by a species of tsetse fly, *Glossina palpalis* (fig. 51), and

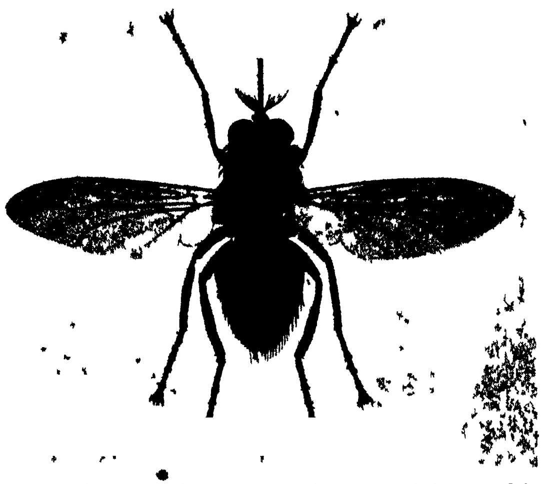


Fig. 51.—*Glossina palpalis*, male, × 3. (From Austen's Monograph.)

by it alone (there is evidence, however, that other species may carry the infection).

That *Glossina palpalis* can carry the disease to susceptible animals is proved by the following experiments:—

*G. palpalis* flies, fed first on a Sleeping Sickness, were then placed on monkeys, and these became affected; the same happened when specimens of the flies caught in the open were allowed to feed on monkeys.

In connection with the conveyance of the parasite of Sleeping Sickness an extremely interesting observation has just been published in the Liverpool Report of the Expedition to the Congo, 1903-4, as regards the commonness in native huts of certain blood-sucking dipterous maggots. These maggots were found by Drs Dutton, Todd, and Christy in crevices in the floors, and beneath the mats on which natives slept. The maggots at night attack sleepers and feed on their blood. The observers found some of the maggots filled with recently-drawn blood.

These maggots are the larvæ of a fly called *Auchmeromyia luteola.* Like the tsetse flies, this is one of the Muscidæ, but the fly itself is not a blood-sucker. Experiment has still to determine whether this maggot plays a part in the transmission of the Sleeping Sickness Trypanosome.

### *The Tsetse Fly* (Glossina morsitans) *and Tsetse-Fly Disease, or Nagana.*

Nagana is a Zulu word, meaning depressed in spirits. For a considerable time the bite or wounding by the proboscis of a fly has been associated with this disease, which, among domesticated animals, occasions great loss. The disease was believed to

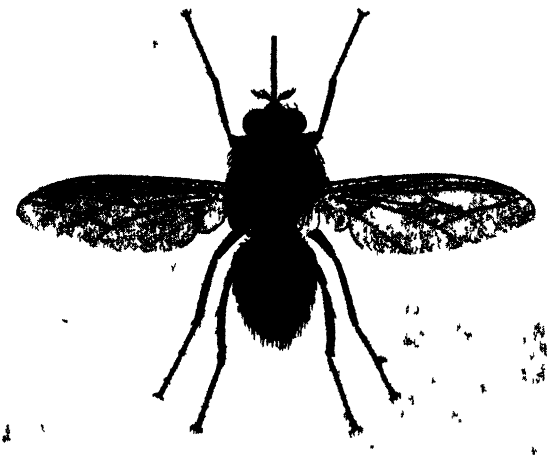


Fig. 52.—*Glossina morsitans*, female, × 3. (From Austen's Monograph.)

be due to a poison injected into the blood by the fly; but in 1895 Bruce, working in Zululand, demonstrated that the fly in its puncturing really acted as first the carrier, and then the introducer into the wound, of a blood parasite. This parasite has been named *Trypanosoma Brucei.*

It is important to note that the term " tsetse " is not the name of one species, but that it is a name applicable to any species of the genus Glossina. The name tsetse refers to the buzzing note characteristic of the flies.

The genus Glossina belongs to the Muscidæ, a family of dipterous insects which numbers in it such wellknown insects as house-flies, and blue- and green-bottles. The genus Glossina has eight species, the flies being grey-brown in colour, with a

prominent projecting proboscis; they vary in length from one-quarter to one-half an inch, not including the proboscis. Glossina species differ from all other blood-sucking two-winged flies, in the way the wings are held when the insects are at rest; they lie flat down the back, closed over one another, like the blades of a pair of scissors. Mr E. E. Austen, of the British Museum, has recently published a fine monograph on the Tsetse Flies.

*Glossina morsitans* (see fig. 52).—This fly is very common in fly-belts in South and Central Africa, and beyond this range it is also found. It may be taken as a type of the tsetse flies. It is active in sunshine during the day, but is sluggish at night and in the early morning. The fly-belts, in which the tsetse flies are found, are generally in the neighbourhood of water; cover is also necessary, therefore the flies are not found in the open plains. The flies have a powerful flight, and they make a characteristic buzzing noise. Both males and females suck blood; in the case of the gad-flies (Tabanidæ) and the mosquitoes (Culicidæ), the females only are blood-suckers. The tsetse fly's mode of feeding is thus described by Captain Crawshay, quoted by Austen: "When a tsetse settles with the intention of feeding — in the early morning they usually simply settle on men's backs to sun themselves away from the ground and vegetation wet with dew—he inserts his proboscis, lowers his head, and raises his abdomen until it is almost vertical; when doing this, and for some little time after he has commenced sucking, he works his wings, buzzing in a minor key, rather like a bee when held forcibly, though not so powerfully; when the keenness of his appetite has been somewhat appeased, he stops working his wings and sucks in silence. If left to himself he will suck until his original skinny barred abdomen (see figs. 53 and 54) becomes a large crimson bead. He is then almost helpless; if touched he will not fly, and if brushed off he will only go a yard or two, to settle heavily on a bush, or

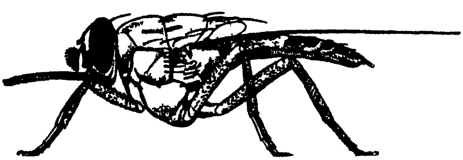


Fig. 53. *Glossina morsitans*, magnified female, before feeding. (From Austen's Monograph.)

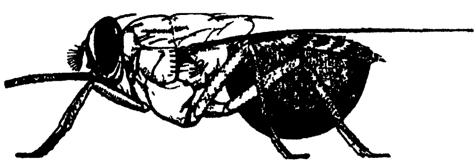


Fig. 54.—*Glossina morsitans*, magnified female, after feeding, showing abdomen distended with blood. (From Austen's Monograph.)

gradually sink down to the ground." The fly only takes twenty or thirty seconds to fill itself.

*Life-history.*—The life-history of the tsetse is interesting, inasmuch as the female does not lay eggs, but nourishes a maggot inside herself, and then places it, full-grown, to the outside, where, in some sheltered place, pupation takes place. The pupa case shows at its posterior end two characteristic lips or prominences.

The Trypanosome, parasitic in Nagana (fig. 55), lives normally in the blood of a number of wild animals—*e.g.*, the hyena, buffalo, koodoo,—and without harm to them; they are immune, as it were, parasite and host having in the course of time become accommodated to one another. Introduced from any of these, however, to the blood of such domesticated animals as horse, mule, donkey, ox, dog, cat, the parasite multiplies, and the Nagana disease follows. The disease is invariably fatal to horses and dogs; but of cattle a small percentage recover. Bruce, experimentally, has placed beyond doubt the fact of the tsetse being able to act as a carrier of the disease. In his experiments, tsetse flies, kept fasting long enough to ensure that any parasites they harboured would have disappeared, were then placed on healthy dogs, and no harm followed their bite and sucking. The tsetse flies were then placed on Nagana-affected dogs, and, after feeding, were allowed to bite and suck from healthy dogs, and these latter took the disease. Tsetse flies were also taken from a diseased area, and conveyed—the journey taking several hours—to a healthy non-infected area, and these, when placed on horses and dogs, communicated the disease. A dog feeding on the raw flesh of a Nagana-infected animal may also become infected.

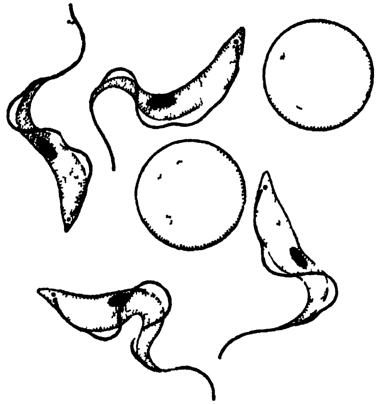


Fig 55 – *Trypanosoma Brucei*, the parasite of Nagana, magnified about 1800 times The two round bodies are blood corpuscles. (From Austen's Monograph)

To Nagana man is immune.

*Surra* (Trypanosoma Evansi).

The disease Surra—this is a Hindoo word meaning rotten—has been known for a long time in districts of India and elsewhere—*e.g.*, in the Philippines in six months it caused a loss of

2000 of the army transport and cavalry horses. The Trypanosome of Surra causes disease in the same animals as with Nagana, and Koch considers the two identical. This opinion, however, has not met with general acceptation, as it is held that there are differences, pathological and other. At any rate the Nagana and Surra Trypanosomes, if really different, are very closely allied. In India the carrier of the Trypanosome is said to be a Tabanus; Curry, in the Philippines, names *Stomoxys calcitrans* as the intermediary. This Stomoxys is one of our own stable flies; it looks extremely like a true house-fly, but can be told by its hard cruel proboscis, and by its wings being held wider apart when the insect is at rest. The flies breed in horse-dung, like the house-fly.

Man is immune as regards Surra. Apart from Surra being naturally carried by dipterous blood-sucking flies, it has been experimentally induced by introducing the blood of a suffering animal below the skin, or into the stomach, of a healthy animal.

### *Dourine* (Trypanosoma equiperdum).

The disease Dourine is known in stallions and brood-mares in South Europe, North Africa, and South America. Experimentally the disease has been induced in dogs and rabbits, and also in rats and mice, but in the two last little or no harm resulted.

### *Insect Agency in the Spread of Diseases.*

Apart from the *rôle* played by insects as the intermediate hosts or the carriers of disease caused by Sporozoa and Flagellata, insects, and especially dipterous insects, may spread other parasitic diseases. A complete list is outside the province of this communication, but there may be mentioned some roundworm and tape-worm infections, and such bacterial diseases as plague, cholera, anthrax, and typhoid fever.

# IMPROVEMENT OF HILL-PASTURE

## AS DETERMINED BY THE EFFECTS ON STOCK —EXPERIMENTS IN SCOTLAND.

By DAVID WILSON, D.Sc., of Carbeth, Killearn

THESE experiments were begun in 1901 by the Highland and Agricultural Society and the West of Scotland Agricultural College, with the co-operation of the Board of Agriculture, and it has been thought desirable that a report of the results for the first four years should now be published.

The method of these experiments is essentially the same as that adopted at the Northumberland County Demonstration Farm of Cockle Park. Dr Somerville, who initiated the well-known experiment in the Tree Field there, published a paper in the 'Transactions' for 1900 (p. 75), in which he describes the rationale of that experiment, and the results for the first three years. It will be sufficient here to say that plots variously treated were grazed by sheep during each summer, and the increase in the live-weight of the sheep was taken as the measure of the effect of the treatment. As is well known, the results have been wonderful. Almost all the treated plots showed a handsome profit, amounting, on a plot to which 10 cwt. of basic slag was applied in 1897, to a net profit estimated at 25s. per acre for every year since, and this upon land valued at 5s. per acre. When the Board of Agriculture suggested that trials of a similar kind might be made in Scotland, and that under certain conditions they would give a grant towards meeting the cost, the Directors of the Highland and Agricultural Society and the Governors of the West College heartily agreed to the suggestion, and accepted the offer. Not that they anticipated such marked results as at Cockle Park, but they were anxious to co-operate with the Board on the basis of joint management and payment; and they recognised that there was a very large area of pastures in Scotland which gave unremunerative returns for grazing, and that some outlay was justified in determining, as nearly as field-experiments could, the profit or loss following the application of manures to such pastures. For this purpose the somewhat troublesome and expensive method adopted seemed to be the only one on which any reliance could be placed; for it is the quality, quite as much as the quantity of the produce, that has to be measured. Even the quantity cannot be tested by cutting and weighing,

as a field regularly hayed soon ceases to be comparable with a pasture.

As the lessons from field-experiments are more or less of local application, and the confidence in such trials largely depends on the results being confirmed by repetition, it was decided to have as many experiments as possible and spread them over different districts. To effect this, each experiment consisted of five plots only, whereas, at Cockle Park, there were originally ten plots for grazing, of 3 acres each. It was further arranged that, if possible, the plots in Scotland should contain 4 acres each.

The Highland and Agricultural Society were fortunate in getting the use of three fields in the east of Scotland, at Sunderland Hall in Selkirkshire, Boon in Lauderdale, and Naemoor in South Perthshire, which as nearly as possible fulfilled the conditions desired for this experiment. These conditions were that each field should contain at least 20 acres, capable of being fenced off into five plots of fairly equal character as regards soil, shelter, and herbage, that the ground had been some time in pasture which showed abundant room for improvement; and finally, that each station should be in a different part of the country, and be typical of a large area of grazing land that might be similarly treated. Every effort was made to get an experimental field in a more northern county, but no land fulfilling these conditions could be obtained. The West of Scotland Agricultural College was successful in obtaining four stations that fairly represented their district, and fulfilled, as well as could be expected, the above conditions—viz., Holestane in Dumfriesshire, Hillridge in Lanarkshire, Boreland in Kirkcudbrightshire, and Auchnaskeoch in Argyllshire. The land at disposal in the two latter places made it necessary to reduce the size of the plots to 3 acres each, but an arrangement which thus enabled the College to include an additional district more than compensated for this curtailment.

The proprietors and farmers from whom these seven fields were obtained have throughout shown the utmost interest in the work, and have been most careful in carrying out every detail. In every case they were assisted by a local committee of farmers and skilled stocksmen, who helped to select the sheep for each plot, attended the monthly weighings, and, as the experiments progressed, gave great assistance by their practical skill and judgment in deciding from time to time the number of sheep that could be most profitably carried by each plot.

Though the dividing fences were arranged so as to make the five plots as equal in character as the confirmation of the ground would allow, it was recognised at most of the stations that there was some variation in the land or herbage that might cause

sheep to do a little better on some plots than on others. It was felt that there would be much reason for regret if results, laboriously obtained during a series of years, should be vitiated in this way, and it was therefore arranged that no manures should be applied the first season (1901), and that that season should be devoted to testing the equality of the plots.

Except at Boon, the same number of sheep were placed on each plot and weighed monthly till the end of the grazing season. The result showed, as was anticipated, some variation in the increase in live-weight obtained from the various plots, and fully justified this preliminary test. It indicated for future years the limit of correction that might be made for inequality of plots.

The treatment of the plots was the same for all the experiments, and is stated in detail in the tables given in this report. The manures on Plots B, C, and D were applied in February 1902, an interval being allowed to elapse between the application of the superphosphate and the ground lime to Plot D.

In giving cake to the sheep on Plot A, the object was not so much to determine whether the extra feeding would give a profitable result in itself, but rather to test whether it was more economical to manure such pastures directly or through the sheep. A mixture of decorticated and undecorticated cotton-cake, half and half, was chosen as a suitable food, giving a valuable manurial residue in proportion to its cost. The cakes were regularly analysed, and the mixture, with little variation, contained 5·3 per cent of nitrogen and 2 per cent of phosphoric acid.

In deciding the manures to be applied to Plots B, C, and D, the main object was to encourage clovers, and ultimately enrich the land by the nitrogen they collect from the atmosphere, and so put it into a condition capable of supporting more productive and nourishing grasses. Basic slag (10 cwt. per acre), and basic slag along with potash were at once selected for two of the plots. The former had given the wonderful result at Cockle Park, and while potash had not been found so necessary there, it might well prove a requisite constituent for the encouragement of clovers on lighter or more moorish soil. There was more difficulty in deciding what manure should be applied to the remaining plot. The choice lay between fine bone-meal and superphosphate along with ground lime. The joint-committee ultimately decided on the latter, mainly because that, next to slag, this combination had proved the most profitable at Cockle Park, and the plot dressed with it there was showing several features of special interest. It was felt that a direct supply of quickly acting nitrogenous manures, such as nitrate of soda or sulphate of ammonia, which would require to be frequently

repeated, was not a practical method of permanently improving such pastures, and the plot at Cockle Park which got sulphate of ammonia in alternate years had proved, next to a heavy dressing of lime, the least profitable of any.

On the whole, the sheep on these plots have remained healthy and thriven well. It was feared that by confining enough sheep to keep down the grass to plots of 4 acres for the whole grazing season the pasture would become foul, and the sheep would not increase in weight nearly so rapidly as if they had a larger run or an occasional change. Except during one season on a plot or two at Boon and Holestane, this has not proved to be the case. On the contrary, the local committees of practical men have generally been surprised at the number of sheep carried on these 4-acre plots, and the increase in weight they have made. When the experiment began movable fences were provided by which a portion of each plot could be spared for a time, and a change given to clean ground. In the east country experiments it was seldom found necessary to resort to this plan, but in all the experiments under the charge of the West of Scotland College the plots were divided by these fences into two equal parts, and as a rule the sheep were grazed alternate weeks on each of these half-plots. In some cases the reserve sheep, which had practically unlimited grazing room, were weighed monthly along with those on the plots, and their increase in live-weight did not materially exceed that of the sheep on the unmanured plot.

Before noticing the main features presented by the seven experiments separately, a few explanations may be given that apply equally to all the tables of results (I. to VII.) In all these tables the results for the years 1901, 1902, 1903, and 1904 are given in three different forms. The last four columns compare the "carrying power" of the plots. On all the experiments it was found that the treated plots would carry more stock than Plot O, which got no treatment. The figures given might have been number of sheep per acre, but as sheep were added or removed from month to month, this would have involved curious "fractions" of a sheep. Moreover, in the different experiments the sheep were of different breeds and weights, and the mean live-weight per acre seemed the best method of comparison. Where the number of sheep remained the same during the season, the "mean live-weight" is the average of the live-weight of the sheep when put on the plot and when taken off it. When sheep were added or removed this has been allowed for, by evident methods, so that the numbers given show accurately the average live-weight per acre during the whole time of grazing. As will be seen later, the interest in those figures arises mainly from the fact that the effect of

treatment has generally been more marked in increasing the carrying power of the pastures than in improving their feeding quality.

These figures, of course, depend upon the judgment of the practical men on the local committees, who put on each plot the number of sheep they thought it could fairly sustain, and, as it is difficult for men even of the greatest skill and experience to stock so that an *anticipated* amount of herbage may be utilised to the greatest advantage, it is not claimed that these figures lend themselves to fine distinctions. As, however, these gentlemen visited the plots monthly, and after careful inspection made such alterations as they saw fit, the mean live-weight per acre in these columns may generally be taken as a very fair measure of the carrying power of each plot. The few exceptions will be referred to later.

The next four columns from the end of the tables give the live-weight gain per sheep per week. Judgment about stocking is scarcely a factor here, for care was taken that the sheep had always enough to eat. This is the verdict of the sheep, and is the most reliable measure of the *feeding quality* of the herbage on each plot.

In the remaining columns the data are given for drawing up a balance between costs and receipts for each plot, and the nett gain or loss of treatment is shown as at the end of the third season. The making up of this balance has involved two matters about which there is room for difference of opinion. Neither point was of much importance at Cockle Park. The results there were quite clear, and it was of little importance if the very handsome profits were a little less or more. But in these Scottish experiments it is entirely different; for the effects of treatment are nothing like so marked, and the details referred to are important factors in the result.

The first difficulty is in regard to how the inequality of plots, as indicated by the increase in live-weight of sheep in 1901, should modify the results in succeeding years. To take an instance from Table I. In the grazing season of 1901, before manures were applied, the live-weight increase per acre was 36 lb. on Plot O and 22½ lb. on Plot B—a difference of 13½ lb. Is this difference to be given effect to in *every one* of the succeeding years? If so, the addition of slag to Plot B at the end of three years has resulted in a nett gain of 6s. 6d.; but if the plots are regarded as equal, the result would be a loss of 3s. 7½d. And other experiments show greater divergences.

On the one side it may be urged that, if one or two sheep on any of the plots in 1901 were exceptionally good or bad thrivers, it would be sufficient to account for most of the apparent inequality between the plots, and that any error thus caused is

multiplied by the number of years the experiment is continued. There were two untreated plots at Auchnaskeoch, which gave a live-weight increase per acre of 41 lb. and 23 lb. respectively in 1901—a difference of 18 lb.; but on the average of the four seasons the increase per annum was 49½ lb. and 43 lb.—a difference of only 5½ lb.

On the other hand, the results in 1901 are as reliable as those of any other single year: all are subject to the same criticism, and in most of the experiments the results obtained in 1901 put the plots in much the same order as was expected by the local committees. In Tables I. to VII. the total increase in the three years (1902, 1903, and 1904) in excess of Plot O is given (*a*) as if all the plots were equal, and (*b*) allowing in *each year* for the difference in the plots indicated by the trial of 1901. The true result is probably somewhere between the two; but for uniformity the profit or loss is taken from (*b*), and any special reason to prefer the other is noticed in referring to the experiments separately.

The other matter of difficulty is the price per lb. that should be put on the live-weight increase of the sheep. The estimate of the amount of profit or loss due to the treatment depends directly on this price, and it is desirable it should be uniform. The method adopted, apparently, in other similar experiments was to assume that 50 per cent of the increase was mutton, and that the increase is therefore worth 3¾d. per lb. if mutton sells at 7½d. In the Scottish experiments, however, this is misleading. The value of summer pasture is what can be realised from it. With very few exceptions the sheep, when taken off the plots, were not fit for the butcher, and were worth more as stores than for killing; and, on an average of years, store-sheep in May cost considerably more per lb. live-weight than they will bring in October. One of the most experienced sheep salesmen in Scotland has been consulted on this matter. After explaining the variations due to seasons, crops, &c., he states that, on an average of the last ten years, he would estimate that sheep of the class used in these experiments would cost 1d. per lb. live-weight more in May than they would bring in October. From this a slight deduction has to be made for value of wool; but even if the difference were only a ½d. per lb., the effect for such sheep as were used in these experiments would be to make the realisable value of the increase about 2½d. per lb.[1] At Cockle Park the average butcher's valuation of the sheep from all the ten plots and for seven seasons (1897 to 1903) was 3s. 1d. per head

[1] *E.g.*, if sheep averaging 70 lb. each in spring cost (after deducting value and weight of wool) 23s. 4d. (=4d. per lb.), and were sold in autumn for 30s. 7½d. (105 lb. at 3½d.), then the increase of 35 lb. has realised 7s. 3½d., or 2½d. per lb.

above what they cost[1] at the beginning of the season, and the average live-weight increase was 36 lb.—*i.e.*, little more than 1d. per lb. for increase. If the live-weight increase of these sheep is to be worth 2½d. per lb., their value as stores must have been on the average 4s. 5d. per head above the butcher's valuation. All the available data in these Scottish experiments has been tabulated for the three seasons, and the average value of the increase comes out at 3d. per lb. This figure has been adopted in the tables in this report, but, owing to the rise in the price of sheep, it is more than could be realised on an average over a longer period.

*Sunderland Hall.*

Table I. gives the results of the experiment at Sunderland Hall. In 1901 the prevailing grass was agrostis, but there was also some Yorkshire fog, cocksfoot, and dogstail, and small plants of white clover could be found over all the plots. In the years 1903 and 1904, when the effects of the manures had become evident, Plots B, C, and D carried about 30 per cent more stock than Plot O; and the individual sheep made about 15 per cent greater increase, showing the improved feeding quality of the pasture. In this experiment the results in 1901 may be taken as a fair measure of the difference between the plots. The experiment was on a hillside, and the plots came in the following order from the higher level downwards: D, A, O, B, C. Plot D was recognised as the best, A and O next and fairly equal, and B and C poorer. This is the order of increase in 1901, and is borne out to some extent by the percentage of nitrogen and organic matter in the surface-soil as shown by the analyses in Table X. The nett gain or loss, as given in Table I., may therefore be taken as a fair statement of the result for the three years.

On Plot A the cost of the cake has not yet been recovered, but its manurial residue may prove worth the 13s. 10d. with which this plot is now debited. The increase of clover and general improvement of the herbage on Plots B and C are well marked. Comparing these two plots, only about half the cost of the potash has yet been repaid; but its effect upon the appearance of the plot was more noticeable than is indicated by this result. Relatively to the cost, the improvement on Plot D has so far been rather disappointing. With the exception of two sheep in 1904, which were immediately replaced, the sheep in this experiment have remained very healthy and thriven exceptionally well; and no experiment of the kind could be conducted with less "probable error."

[1] Deducting value of wool.

*Boon.*

Table II. gives the results obtained at Boon. The pasture here is much rougher than at Sunderland Hall, and is mostly composed of agrostis, but Yorkshire fog, sweet vernal, dogstail, and cocksfoot are also present, and there are plants of white clover all over the plots. In all the other experiments the same number of sheep were put on each plot in 1901; but here the local committee varied the stocking in accordance with the appearance of the plots, and their judgment was justified to the extent that the live-weight gain per sheep per week on all the plots was almost identical in that year (1·2 lb.) At the end of the season, however, some food was left on Plot O, which had grazed only nine sheep; and it is fairly evident that if another sheep or two had been grazed on Plots O, C, and D they would have made some increase. The allowance, therefore, for the results of 1901 is probably exaggerated in this experiment. The live-weight increase in three years of Plot B, *e.g.*, over Plot O, is probably nearer 94½ lb. (from *a*) than 61½ lb. (from *b*).

On Plot A the difference would be even more marked; but even allowing for this, the feeding of cake on Plot A has so far proved very unprofitable. To keep down the strong rough growth, this plot was heavily stocked—four sheep per acre in 1904. This involved a large consumpt of cake, and on the confined area the sheep did not make corresponding progress. Two sheep were removed from this plot in 1904 owing to foot-rot, and the progress of at least five others suffered from the severe foot-dressings that were necessary.

In this experiment no safe inference can be drawn from the stock carried by the different plots. The difference was as marked in 1901 as in the other years, and in all the plots a considerable roughness was left at the end of the season. The cattle put on in 1903 reduced this slightly, but they seemed not to relish the agrostis any more than the sheep. In the spring of 1904 some of the coarsest herbage was burned off.

It is not wonderful that the action of an insoluble manure like slag should be slower on a pasture like this, covered with such a quantity of coarse grass and with a dense sod; and it is noticeable that upon all the treated plots the increase has been greatest in 1904. On these plots the live-weight gain per sheep was greater than on Plot O, although they were much more heavily stocked. The clover plants are more vigorous on the plots which got phosphatic manure, but there is no evidence of the addition of potash causing any marked improvement.

On the whole, the skilled stock farmers who are in charge of this experiment, while they recognise that the slight increase in

1904 may be the beginning of a more evident improvement in 1905, do not think that the results up to this time give much encouragement for manuring this class of pasture.

*Naemoor.*

Table III. gives the results obtained at Naemoor. As will be seen from the live-weight carried per acre, the pasture here was less productive than at the two preceding places. Along with agrostis, hard fescue and sheep's fescue are prevalent, and though the leaves of these smaller fescues contain a high percentage of albuminoids when grown on rich soil, they become wiry, and seem neither palatable nor nourishing on second-class hill pastures.

In 1904 the manured plots have carried 35 per cent more stock, and at the same time the individual sheep have increased 35 per cent more in live-weight than those on Plot O. There is here distinct evidence of improvement, both in the quantity and quality of the herbage. As at Sunderland Hall, observation of the land, the uniformity of the increase from Plot O in the four years, and to some extent the analyses of the soils, all confirm the results obtained in 1901 as to the relative productiveness of the plots, and the nett gain or loss as given in the table (from *b*) may be accepted as trustworthy.

On none of the plots has the cost of treatment yet been repaid. The additional food given daily on Plot A has not increased the weight of the sheep so much as the improved pasture on Plot C, and the debit of 13s. 8d. is a considerable proportion to be recovered of the outlay of 32s. 10d. for cake. The increase from the slag plot is greatest in 1904, and another such year would clear the deficit. The addition of potash has up till this time only been about half repaid, and the combination of superphosphate and lime has so far been least effective. The sheep all remained perfectly healthy and throve very well.

*Holestane.*

Table IV. gives the results at Holestane. The pasture here is much more productive than any of the others under the charge of the West of Scotland College. It differs from the other experimental fields in containing a considerable proportion of some of the best top grasses—viz., meadow fescue, timothy, and cocksfoot — and the mean live-weight per acre shows that all the plots carried a large stock.

There was room on this field for an additional plot (Plot X in the table), and to this bone-meal was applied.

In this experiment there is no good proof of the feeding

quality of the pasture having yet been improved by the treatment, for the live-weight gain per sheep per week has not been materially increased. On the other hand, there has been a considerable increase in the carrying power, but for reasons stated in connection with the other rough pasture at Boon, it would be misleading to state this increase as a percentage.

Heavy stocking was necessary to make use of the abundant pasture, and before the end of season 1903 it was evident the sheep were not thriving well on the most heavily stocked plots. The land had become foul, and the rougher grasses had not been sufficiently kept down. Accordingly it was arranged to graze both cattle and sheep on the plots in 1904, and so far the result has been satisfactory. The column of "nett gain or loss" shows a small profit on the slag plot, which would have been greater but for this difficulty in 1903. It is possible, however, that the results in 1901 exaggerated the superiority of Plot O, and that column (*b*) unduly favours the treated plots. In that year there was not much difference in the appearance of the plots, which were all on level ground.

This experimental field has turned out to be more productive than was anticipated, and on this account is perhaps scarcely so suitable for these trials, but the experiment is very carefully conducted, and may yet yield valuable results.

### *Hillridge.*

Table V. gives the results obtained at Hillridge. Here also the live-weight gain per sheep does not indicate any marked improvement in the feeding quality of the pasture on the manured plots, but the carrying power has been increased by about 25 per cent on the average of 1903 and 1904. The plots upon this experiment run side by side from the top to the bottom of a hill. Although the whole plots are fairly equal, the north portions of all lie on shallow bare soil, while the south portions running to the bottom of the hill contain deeper and better land. On the north portions, in 1901, there was a scanty herbage of agrostis with some ling heather, rashes, and thistles. The southern portions were much greener and more productive, agrostis being the prevalent grass, along with Yorkshire fog and sweet vernal; and there are a few plants of white clover all over the plots. Plot O was recognised as naturally the best plot, and the allowance for the inequality of plots in Table V. (under *b*) is probably justified. Meantime the debit against Plot A is nearly half the cost of the cake. The live-weight increase on the slag plot has increased every year, and though potash has not yet repaid its cost, its effects are evident in the look of the pasture.

*Boreland.*

The results obtained at Boreland are given in Table VI. Here, as at Naemoor, there is a considerable quantity of hard fescue along with agrostis. When the experiment commenced there was a sprinkling of leguminous herbage, including white clover. As is apparent from the live-weight carried in 1901, and from the small increase made by the sheep that season, the pasture is not naturally a productive one. The stock carried upon the manured plots in each of the three years 1902, 1903, and 1904 has been practically 50 per cent above that carried upon Plot O, and at the same time the sheep upon the manured plots in 1903 and 1904 have made distinctly greater progress.

The increased quantity of food is the most marked effect of the manures in this experiment, but the quality has also been improved, and the gain per sheep on the manured plots is highest in 1904. The results in 1901 prove that the plots were very nearly equal. Slag has already paid its cost. Potash has produced a marked improvement on the appearance of the pasture, but, for reasons not apparent, this is not yet shown to a corresponding degree in the live-weight increase. As in most of the other experiments, superphosphate and lime have proved scarcely so effective as slag, while costing much more. The cake-fed plot does not at present promise a profitable result—in fact, the sheep on Plots B and C have increased more in weight than those receiving daily a liberal allowance of cake.

*Auchnaskeoch.*

Table VII. gives the results at Auchnaskeoch. This was an extra experiment, undertaken by the West of Scotland Agricultural College, and as they could not arrange for the sheep being fed with cake daily, Plots A and O were both untreated throughout. The varied herbage on the experimental land here is representative of much hill-pasture in Argyleshire. Bare spots here and there are overgrown with lichens, and some patches are so wet that they produce little more than moss, while some are covered with brackens. In other places ling heather is fairly abundant. Agrostis is the prevailing grass with dogstail in patches, and a little white clover. It would be difficult, however, to select from observation one plot as better than another, as they are all equally varied in nature and diverse in produce.

Here, again, the stock carried by the plots has been much increased, following the application of manures. The mean live-weight on the manured plots was about 50 per cent in 1903, and 55 per cent in 1904, above the mean live-weight

upon the unmanured plots O and A. The live-weight gain per sheep is, like the pasture, varied and difficult to interpret even with the help of two unmanured plots. The sheep on Plot C, for example, throve very badly in 1904, and still they seemed all quite healthy. If no allowance is made for 1901, Plot B would have already nearly paid for the slag; on the other hand, under these conditions Plot C would have showed considerably greater loss.

Meantime it seems as if this station, for a different reason from Holestane, is not the most suitable for this experiment.

### *Hay Plots.*

The areas grazed were as stated in the tables following, but the fences enclosed (except at Auchnaskeoch) $\frac{1}{20}$th of an acre more on every plot. These sub-plots of $\frac{1}{20}$ of an acre were fenced off, and their produce cut and weighed. Their position on the larger plots was changed annually. The weights of hay obtained, calculated to cwts. per acre, are given in Table VIII. Though the larger plots were fairly comparable the one with the other, there was in almost all the experiments considerable variation in the nature and vigour of the herbage in different parts of the same plot.

These small sub-plots for cutting were placed by the local committees to represent an average portion of the larger plots, but to those who regularly visited the experiments it was evident that the weight of hay obtained from them was at least as much dependent on their position as upon the treatment the plot had received In such variable pastures the weight of hay from $\frac{1}{20}$th of an acre formed no fair test of the productiveness of 4 acres. An examination of the returns bears this out, and shows that it would be entirely misleading to base any general conclusions upon them.

This table, in the meantime, is of use mainly in justifying the method that has been adopted in these experiments for measuring the improvement of pastures, for it proves conclusively that the much easier method of cutting and weighing about 1 per cent of the treated areas gives, on such pastures, an entirely unreliable measure even of the quantity produced on the whole area.

The hay from these sub-plots was submitted to botanical analysis by Professor M'Alpine, who also visited the experiment stations from time to time, and has taken complete and voluminous notes of the nature and variation of the herbage. For the reasons given above, and also because the low-growing herbage was not proportionately represented in the hay, the analyses without the notes are, in the opinion of Professor

M'Alpine, misleading, and it has been thought better that he should supply a complete Botanical Report of the effects of treatment at a later date.

### *Report on Carcasses.*

It was arranged that at the end of each season an average sheep should be selected from each plot and slaughtered, and the carcass weighed. This was done at Sunderland Hall and Boon, and at Naemoor and Hillridge in 1902, and the results are given in Table IX. In the other cases the whole of the sheep were so evidently unfit for the butcher that the joint-committee did not insist on slaughter. The small difference in the percentage of carcass in such stores probably depended more on the selection of the sheep for slaughter than on the treatment the plot had received.

Mr M'Bryde of Newcastle, who killed the Boon sheep, reported that they were all about equal as to quality, and all prematurely in the market. The butcher who slaughtered the Sunderland Hall sheep in 1904 reported that those selected from Plots A and B were "nice quality," from Plots C and O "fair quality," from Plot D "poor quality," and one of the reserve sheep grazed outside the plots, which gave 42·2 per cent of carcass, "rather poor quality."

### *Survey of Results.*

No useful information could be got from average tables prepared from all these seven experiments, for each varied from the other in the all-important factors of climate, soil, and herbage. It is not the object of this preliminary report to deduce definite conclusions. At the same time, it is evident that the results so far obtained are very disappointing compared with those obtained during the first three years of the similar experiment at Cockle Park. The profit shown there was quite astonishing, but no figures nor description could produce the impression received on visiting the plots themselves. The herbage and sheep had to be seen to realise it. There is nothing approaching this in any of the Scottish experiments. A little improvement in the appearance of the treated plots, but, speaking generally, that is all.

What is the cause of the difference? Professor Middleton, in a very interesting report,[1] has ascribed the wonderful effects at Cockle Park to its being a "true slag soil." He defines a slag soil as "a poor clay pasture covered with small clover plants and with bent (*Agrostis sp.*)." The agrostis does not make a close sward on the clay-soil pastures in Northumberland,

[1] Sixth Annual Report of Experiments at Cockle Park (1902), pp. 14-16.

and when the slag encourages the clover, it has room to spread, and its runners are sheltered by a "rough thin covering of agrostis." All the good effects of an abundant and vigorous growth of clover follow, changing in a few years the whole character of the herbage.

Several of the Scottish soils come near Professor Middleton's description of a slag soil. Agrostis is the prevailing grass, more so than at Cockle Park, poor little clover plants can be found all over, the soil is stiff, and there is generally plenty of moisture; but on these stiff soils the agrostis along with other low-growing herbage does form a thick and close sward. It may well be that the slowness of effect of the slag, on such pastures as those at Boon and Holestane, is not so much due to the time the insoluble phosphoric acid requires to get through this dense sod and mass of inert organic matter to the roots, as to the fact that the vigour and spread of clover is checked from want of room. The barer the soil the more rapid is the effect of slag.

It has to be remembered, however, that this Northumberland clay is not a "poor" soil. When wheat was selling at 50s. per quarter it commanded a rent of 30s. an acre and upwards. After it had been grazed twenty or thirty years it was starving for want of phosphates. That was the weak link in a fairly strong chain. Given an abundant supply in the slag, this soil, in other respects naturally good, physically and chemically, by the help of clover, soon accumulates nitrogen and organic matter, and becomes capable of fattening sheep or cattle. From being worth 5s, it becomes in a few years worth 26s. an acre.

The large area of poor pastures in Scotland are not, however, on land of this class. The Cockle Park soil contained only 005 per cent of available phosphoric acid, as determined by Dyer's method, while the Scottish soils, of which analyses are given in Table X., contained from four to twelve times this amount. In fact, judged by this method, they were considerably richer in available phosphoric acid before treatment than was the Cockle Park soil after it had received 10 cwt. slag per acre.

From both points of view—the thick-set sod and the soil content—it is not wonderful that these Scottish soils are not so grateful for an application of basic slag. The wants of second-class soils like these seem to be more general. They are not always clearly indicated by analysis, and may be more physical and biological than chemical. It is comparatively easy to increase by manuring the quantity of produce, whether it be turnips, straw, or grass, from such soils, but experiments so far have failed to materially increase the feeding quality of this produce. This kind of poor land cannot be made into a fattening

pasture, at all events cheaply or quickly. Clovers and the best grasses may be encouraged, but they have not the virtue that belongs to them on "good land."

While, however, it is already evident that there will be no such rapid transformation as was effected at Cockle Park, it by no means follows that the treatment of these pastures will not ultimately prove profitable. In all the experiments there has been a marked increase in the quantity of stock the land has carried, and in most cases this increased stock has been better done. It has to be remembered that in all the tables the treated plots are credited with the increase produced during about twenty weeks only of each year. Such hill pastures are generally grazed all the year round, and there is no doubt that they would continue to be more nutritive during the other thirty-two weeks. Moreover, as has been observed, no value has been put on the manurial residues. In some of the experiments, even without making allowance for these assets, the cost of the slag has been already repaid, as well as a considerable part of the cost of the potash. Generally the increase over the unmanured plot in 1904 is as great as, and in some cases considerably greater than, in either of the previous years, and it only requires that this maximum be continued for two or three years longer to make the treatment distinctly profitable.

At the present stage the eating on of cake seems over all the least promising outlay. If the clover had been encouraged, and better grasses established before cake was given, the good effect of the manurial residue would probably have been more evident. The feeding of cake on Plots A will soon be stopped and the value of the residue tested, and observation of the various plots from time to time may suggest variations in the treatment of the other plots.

Meantime the joint-committee have decided to make no changes for at least one more season.

The committee are much indebted to the gentlemen who conducted these experiments for the great care they have taken to obtain accurate results. They are also indebted to all the local committees for the valuable assistance they have rendered.

[TABLES.

TABLE I.—SUNDERLAND HALL. EXPERIMENT conducted by C. H. SCOTT PLUMMER, Esq., at his Home Farm, Sunderland Hall, Selkirkshire. *Pasture*—[illegible] years old; *Elevation*—800 feet. Shallow light soil resting on yellow clay and rock. Plots of four acres grazed by Cheviot Gedder Hoggs. Experiment begun 1901, Manures applied February 1902.

In 1901 each plot was grazed by 6 sheep for 16⅔ weeks (June 10 to Oct. 3). On May 13, 1902, 8 sheep were placed on Plots A and D, and 7 on Plots B, C, and O. On June 14, 1 sheep was added to Plot A and 1 to Plot C. Grazing ceased Oct. 2 (20 weeks). On May 15, 1903, 9 sheep were placed on Plots A, B, C and D, and 7 on Plot O. No alterations were made, and grazing ceased Oct. 16 (22 weeks). On May 17, 1904, 10 sheep were placed on Plots A, B, C and D, and 8 on Plot O. One sheep on Plot C was replaced on July 16, and 1 on Plot O on Aug. 17, as they were not thriving. Grazing ceased Oct. 12 (21 weeks). Deducting wool the sheep cost per head in 1902 22s., in 1903, 25s. 6d., and in 1904, 25s. When taken off, butcher's returns gave per head—28s. 7½d. in 1902, 29s. 8d. in 1903, and 33s. 2d. in 1904, but on the average the sheep were worth about 2s. per head more as stores.

RESULTS PER ACRE

| Plots | Live weight increase in 1901 (testing equality of plots) | Treatment per acre | Cost of treatment | Live weight increase of sheep in 1902 | 1903 | 1904 | Total | Live weight increase in three years in excess of Plot O: (a) No allowance | (b) Allowing for inequality of plots as shown in 1901: Weight in lb | Value at 3½d per lb | Nett gain + or loss − from (b) and cost | Live weight gain per sheep per week during season 1901 | 1902 | 1903 | 1904 | Carrying Power: Mean live weight per acre in 1901 | 1902 | 1903 | 1904 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb | | s. d. | lb | lb | lb | lb | lb | | s. d. | s. d. | lb | lb | lb | lb | lb | lb | lb | lb |
| A | 33 | Total of 8¼ cwt cotton cake half decorticated eaten by sheep in 1902, 1903, and 1904 (=48 lb nitrogen) | 49 7 | 86½ | 103 | 147 | 336½ | 134 | 143 | 35 9 | −13 10 | 1·33 | 1·97 | 2·08 | 2·80 | 162 | 202 | 207 | 241 |
| B | 22½ | 10 cwt basic slag (=200 lb phosphoric acid) | 22 6 | 59 | 96 | 123 | 278 | 75¾ | 116 | 29 0 | + 6 6 | ·91 | 1·69 | 1·94 | 2·34 | 157 | 156 | 202 | 229 |
| C | 22 | 10 cwt basic slag and 210 lb sulphate of potash (=100 lb potash) | 35 9 | 72 | 109 | 122 | 303 | 100¾ | 142¼ | 35 7¼ | − 0 1¼ | ·89 | 1·85 | 2·20 | 2·32 | 156 | 180 | 209 | 229 |
| D | 41½ | 9 cwt superphos (=200 lb phos acid) and half ton ground lime | 40 7 | 73 | 97 | 121 | 291 | 88¾ | 72 | 18 0 | −22 7 | 1·68 | 1·82 | 1·96 | 2·31 | 165 | 191 | 204 | 228 |
| O | 36 | Untreated | | 49 | 69¼ | 84 | 202¼ | | | | | 1·46 | 1·41 | 1·90 | 2·00 | 165 | 152 | 156 | 179 |

**TABLE II.—BOON.** EXPERIMENT conducted by Dr R. SHIRRA GIBB, Boon, Lauder, Berwickshire. *Pasture*—17 years old; *Elevation*—900 feet. Blackish moorland soil resting on boulder-clay. Plots of four acres grazed by Cheviot Wedder Hoggs, home-bred. Experiment begun 1901; Manures applied February 1902.

On June 1, 1901, 12 sheep were placed on Plot A, 11 on Plot B, 10 on Plots C and D, and 9 on Plot O. Two sheep on Plot A died from inflammation and were replaced. Grazing ceased Oct. 4 (17 6/7 weeks). On May 23, 1902, 11 sheep were placed on Plot A, 9 on Plots B, C, and D, and 8 on Plot O. Grazing ceased Sept. 30 (18 4/7 weeks). After the sheep were removed 18 cattle were put on each plot in succession for 48 hours. On May 16, 1903, 12 sheep were placed on Plot A, 10 on Plots B, C, and D, and 8 on Plot O. One sheep on Plot C was changed on June 29. Fourteen cattle were grazed for 24 hours on each plot. Grazing ceased Oct. 17 (21 6/7 weeks). On April 21, 1904, 12 sheep were placed on Plot A, 10 on Plots B, C, and D, and 8 on Plot O. On May 25, 4 sheep were added to Plot A, 2 to Plots B and D, and 1 to Plot C. On Sept. 15, 1 sheep on Plots A and D were removed because of foot-rot, and not replaced, and 6 others in Plot A suffered. Grazing ceased Oct. 17 (25 4/7 weeks). All five plots are credited for cattle grazing in 1902 and 1903 (at 1s. per head per week)=7s. 2d. =1s. 9½d. per acre. Deducting wool, the sheep were valued when put on—21s. 4d. in 1902, 23s. 6d. in 1903, and 25s. 8d. in 1904, when taken off, by butcher—30s. in 1902, 29s. in 1903, and 33s. 8d. in 1904, but worth about 2s. a-head more as stores.

RESULTS PER ACRE

| Plots. | Live-weight increase in 1901 (testing equality of plots). | Treatment per acre | Cost of treatment. | | Live-weight increase of sheep in | | | | Live-weight increase in three years in excess of Plot O | | | | Nett gain + or loss − from (b) and cost | | Live-weight gain per sheep per week during season | | | | Carrying Power. Mean live-weight per acre in | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1902 | 1903 | 1904 | Total | (a) No allowance | (b) Allowing for inequality of plots as shown in 1901: Weight in lb | Value at 3d per lb | | | | 1901 | 1902 | 1903 | 1904. | 1901 | 1902 | 1903 | 1904. |
| | lb. | | s. | d. | lb | lb | lb. | lb. | lb | | s. | d. | s. | d. | lb. | lb. | lb. | lb | lb. | lb. | lb. | lb. |
| A | 63 | Total of 14 cwt. cotton-cake, half decorticated, eaten by sheep in 1902, 1903, and 1904 (=83 lb. nitrogen) | 94 | 0 | 96 | 135½ | 147 | 378½ | 215 | 164 | 41 | 0 | −53 | 0 | 1·18 | 1·89 | 2·07 | 1·62 | 224 | 251 | 266 | 341 |
| B | 57 | 10 cwt. basic slag (=200 lb. phosphoric acid) | 22 | 6 | 63 | 80 | 115 | 258 | 94½ | 61½ | 15 | 4½ | − 7 | 1½ | 1·16 | 1·53 | 1·46 | 1·55 | 207 | 199 | 205 | 261 |
| C | 52½ | 10 cwt. basic slag and 210 lb. sulphate of potash (=100 lb. potash) | 35 | 9 | 57 | 82 | 89 | 228 | 64½ | 45 | 11 | 3 | −24 | 6 | 1·19 | 1·38 | 1·50 | 1·30 | 181 | 196 | 207 | 232 |
| D | 56 | 9 cwt. superphos. (=200 lb. phos. acid) and half ton ground lime | 40 | 7 | 59½ | 70 | 93½ | 223 | 59½ | 29½ | 7 | 4½ | −33 | 2½ | 1·26 | 1·43 | 1·28 | 1·34 | 180 | 197 | 200 | 250 |
| O | 46 | Untreated . . . . . | . | | 51 | 47½ | 65 | 163½ | | | . | | | | 1·16 | 1·37 | 1·09 | 1·28 | 158 | 174 | 158 | 168 |

**TABLE III.—NAEMOOR.** EXPERIMENT conducted by J. J. MOUBRAY, Esq. of Naemoor, Rumbling Bridge, Perthshire. *Pasture*—32 years old; *Elevation*—600 feet. Stony moorland soil on stiff subsoil. Plots of four acres grazed by Blackfaced Sheep, two-year-old Wethers in 1901, Wether Hoggets in 1902 and 1903, and Ewe Hoggets in 1904. Experiment begun 1901; Manures applied February 1902.

Six sheep were grazed on each Plot in 1901 for 17¾ weeks. On May 23, 1902, 6 sheep were placed on each Plot, and grazed till Sept. 23 (17¾ weeks). On May 12, 1903, 7 sheep were placed on each plot. On Aug. 12, 2 sheep were added to Plot A, 1 to each of Plots B, C, and D, and 1 was removed from Plot O. Grazing ceased Oct. 12 (21½ weeks). On May 27, 1904, 8 sheep were placed on Plot A, 7 on each of Plots B, C, and D, and 6 on Plot O. On Aug. 27, 3 sheep were added to Plot A, and 2 to each of Plots B and D. Grazing ceased Sept. 27 (17¾ weeks). Deducting wool, sheep cost per head 12s. 3d. in 1902, 15s. 3d. in 1903; and 16s. 9d. in 1904. When removed from the plots they were sold as stores for 19s. each in 1902; 22s. 8d. in 1903, and 25s. in 1904.

RESULTS PER ACRE

| Plots. | Live-weight increase in 1901 (testing equality of plots) | Treatment per acre | Cost of treatment | Live-weight increase of sheep in 1902 | 1903 | 1904 | Total | Live-weight increase in three years in excess of Plot O: (a) No allowance | (b) Allowing for inequality of plots as shown in 1901: Weight in lb. | Value at 3d. per lb. | Nett gain + or loss − from (b) and cost | Live-weight gain per sheep per week during season 1901 | 1902 | 1903. | 1904. | Carrying Power. Mean live-weight per acre in 1901. | 1902. | 1903. | 1904. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb. | | s. d. | lb. | lb. | lb. | lb. | lb. | | s. d. | s. d. | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. |
| A | 33 | Total of 5½ cwt. cotton-cake, half decorticated, eaten by sheep in 1902, 1903, and 1904 (=33 lb. nitrogen) | 32 10 | 48½ | 77 | 64 | 189½ | 70½ | 76½ | 19 1½ | −13 8½ | 1·26 | 1·86 | 1·81 | 1·69 | 139 | 124 | 174 | 179 |
| B | 28 | 10 cwt. basic slag (=200 lb. phosphoric acid) | 22 6 | 45 | 53 | 61½ | 159½ | 40½ | 61½ | 15 4½ | − 7 1½ | 1·06 | 1·74 | 1·33 | 1·88 | 127 | 123 | 157 | 162 |
| C | 29 | 10 cwt. basic slag and 210 lb. sulphate of potash (=100 lb. potash) | 35 9 | 57 | 74 | 60 | 191 | 72 | 90 | 22 6 | −13 3 | 1·12 | 2·18 | 1·84 | 1·96 | 129 | 124 | 173 | 139 |
| D | 25 | 9 cwt. superphos. (=200 lb. phos. acid) and half ton ground lime | 40 7 | 52 | 58 | 59 | 169 | 50 | 80 | 20 0 | −20 7 | ·98 | 1·98 | 1·45 | 1·81 | 138 | 132 | 165 | 157 |
| O | 35 | Untreated . . . . | | 39 | 44 | 36 | 119 | | | | | 1·33 | 1·49 | 1·27 | 1·39 | 133 | 123 | 141 | 113 |

TABLE IV.—HOLESTANE. EXPERIMENT conducted by Mr JOSEPH BROWN, Manager, Home Farm of the Duke of Buccleuch, Holestane, Thornhill, Dumfriesshire. *Pasture*—14 years old; *Elevation*—600 feet; *Soil*—medium strong loam resting on till. Plots of four acres grazed by Cross Hoggs (and cattle in 1904). Experiment begun 1901; Manures applied February 1902. The grazing season extended to twenty weeks in 1901, 1902, 1903, and 1904.

In 1901, each plot was grazed by 14 sheep (May 20 to Oct. 7) In 1902, 18 sheep were on May 13 placed on Plots A, B, C, D, and X, and 14 on Plot O. On Aug. 5, 4 sheep were removed from Plots A, B, C, D, and X, and grazing ceased Sept. 30 On May 12, 1903, 16 sheep were placed on Plots A, B, C, D, and X, and 14 on Plot O. No alterations were made, and grazing ceased Sept. 29. On May 10, 1904, 10 sheep and 2 cattle were placed on Plots A, B, C, D, and X, and 8 sheep and 2 cattle on Plot O. On Aug. 4, one of the cattle was removed from Plots A and D. Grazing ceased Sept. 29.

RESULTS PER ACRE.

| Plots. | Live-weight increase in 1901 (testing equality of plots). | Treatment per acre. | Cost of treatment | Live-weight increase of sheep in 1902 | 1903 | 1904 | Total | Live weight increase in three years in excess of Plot O: (a) No allowance | (b) Allowing for inequality of plots as shown in 1901: Weight in lb | Value at 3d per lb | Live weight increase of cattle in 1904: Weight in lb. | Value in excess of Plot O at 2½d per lb | Nett gain + or loss − from (b), cattle, and cost | Live-weight gain per sheep per week during season 1901 | 1902 | 1903. | 1904 | Carrying Power. Mean live-weight per acre in 1901. | 1902. | 1903. | 1904.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb | | s. d | lb. | lb. | lb. | lb. | lb. | | s d | | s. d | s. d. | lb | lb | lb. | lb. | lb | lb. | lb. | lb. |
| A | 99½ | Total of 8⅝ cwt. cotton-cake, half decorticated, eaten by sheep in 1902, 1903, and 1904 (=51 lb. nitrogen) | 52 0 | 140½ | 150 | 113 | 403½ | 86½ | 124 | 31 0 | 76 | 2 5 | −18 7 | 1 42 | 1 71 | 1·88 | 2 26 | 299 | 330 | 322 | 226 |
| B | 104 | 10 cwt basic slag (= 200 lb. phosphoric acid) | 22 6 | 166½ | 123 | 97 | 386½ | 69½ | 93½ | 23 4½ | 79 | 3 0 | + 3 10½ | 1·49 | 2·03 | 1·54 | 1·93 | 303 | 339 | 308 | 217 |
| C | 100 | 10 cwt. basic slag and 210 lb. sulphate of potash (=100 lb potash) | 35 9 | 142 | 134½ | 86½ | 363 | 46 | 82 | 20 6 | 73 | 1 9 | −13 6 | 1 43 | 1·73 | 1·68 | 1·73 | 300 | 328 | 316 | 213 |
| D | 94 | 9 cwt. superphos. (= 200 lb. phos. acid) and half ton ground lime | 40 7 | 150½ | 130 | 94 | 374½ | 57½ | 111½ | 27 10½ | 83½ | 3 11 | − 8 9½ | 1·34 | 1 83 | 1·62 | 1·88 | 298 | 335 | 312 | 217 |
| X | 87 | 7½ cwt. bone-meal (= 200 lb. phos. acid) and 32 lb. nitrogen | 37 6 | 132½ | 123 | 89 | 344½ | 27½ | 102½ | 25 7½ | 87 | 4 8 | − 7 2½ | 1·24 | 1·61 | 1·55 | 1·77 | 292 | 326 | 309 | 213 |
| O | 112 | Untreated | | 118 | 125 | 74 | 317 | | | | 64½ | | | 1·60 | 1·68 | 1·79 | 1 85 | 306 | 274 | 278 | 173 |

* Together with cattle in 1904

TABLE V.—HILLRIDGE. EXPERIMENT conducted by Messrs LAMBIE, Hillridge, Biggar, Lanarkshire. *Pasture*—5 years old; *Elevation*—1200 feet. Light stony land overlying whinstone. Plots of four acres grazed by Blackfaced Wedders 1901 and 1902, and Cheviot Wedders 1903 and 1904 Experiment begun 1901; Manures applied February 1902. The grazing season extended to twenty weeks in 1901, 1902, 1903, and 1904.

On May 15, 1901, 4 sheep were placed on each plot, and on June 12, 4 additional sheep were put on each plot and remained to end of grazing on Oct. 2. On May 16, 1902, 12 sheep were put on Plots A. B, C, and D, and 8 on Plot O. On Aug 8, 4 sheep were removed from Plots A, B, C, and D. Grazing ceased Oct 3 Seventeen cattle were grazed for 30 hours on Plot O and for 20 hours on each of the other plots. On May 15, 1903, 10 sheep were placed on Plots A, B, C, and D, and 7 on Plot O. On Aug. 7, 2 sheep were removed from Plots A, B, C, and D. Grazing ceased Oct 2. Twenty cattle were grazed for 74 hours on Plot O On May 13, 1904, 10 sheep were placed on Plots A, B, C, and D, and 8 on Plot O. No alteration was made, and grazing ceased Sept. 30. Deducting wool, the sheep were valued per head when put on the plots—14s. 8d. in 1901 and 1902, 20s. 9d in 1903, and 18s 9d in 1904; when taken off, at 21s. in 1901 and 1902, 30s. in 1903, and 31s in 1904

RESULTS PER ACRE.

| Plots. | Live-weight increase in 1901 (testing equality of plots) | Treatment per acre. | Cost of treatment | Live-weight increase of sheep in 1902 | 1903 | 1904 | Total | Live-weight increase in three years in excess of Plot O: (a) No allowance. | (b) Allowing for inequality of plots as shown in 1901: Weight in lb | Value at 3d per lb | Value of cattle grazing Plo O in excess of other plots at 1s per head per week | Nett gain + or loss − from (b), cattle, and cost | Live-weight gain per sheep per week during season 1901. | 1902 | 1903 | 1904 | Carrying Power. Mean live-weight per acre in 1901 | 1902. | 1903 | 1904 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb. | | s d | lb | lb. | lb | lb | lb. | | s. d. | s. d | s d | lb. | lb | lb. | lb. | lb. | lb. | lb. | lb. |
| A | 50 | Total of 8⅓ cwt. cotton-cake, half decorticated, eaten by sheep in 1902, 1903, and 1904 (=48 lb. nitrogen) | 48 9 | 87½ | 88 | 112½ | 288 | 81½ | 120½ | 30 1½ | −2 6 | −21 1½ | 1·39 | 1·68 | 1 91 | 2 24 | 118 | 174 | 186 | 196 |
| B | 62½ | 10 cwt basic slag (=200 lb. phosphoric acid) | 22 6 | 75½ | 79½ | 102 | 257 | 50½ | 52 | 13 0 | −2 6 | −12 0 | 1·74 | 1·45 | 1·73 | 2 04 | 128 | 171 | 183 | 189 |
| C | 49 | 10 cwt. basic slag and 210 lb. sulphate of potash (=100 lb potash) | 35 9 | 80 | 77½ | 94 | 251½ | 45 | 87 | 21 9 | −2 6 | −16 6 | 1·36 | 1 53 | 1 69 | 1·88 | 124 | 174 | 180 | 185 |
| D | 44 | 9 cwt. superphos. (=200 lb. phos. acid) and half ton ground lime | 40 7 | 62 | 61 | 86 | 209 | 2½ | 59½ | 14 10½ | −2 6 | −28 2½ | 1·23 | 1·19 | 1·34 | 1·72 | 121 | 168 | 174 | 182 |
| O | 63 | Untreated . . . | . | 62 | 62 | 82½ | 206½ | | | . | | | 1·74 | 1·54 | 1·76 | 2·06 | 132 | 134 | 141 | 153 |

TABLE VI.—BORELAND. EXPERIMENT conducted by Mr GEORGE BRYSON, Boreland, Parton, Kirkcudbrightshire. *Pasture*—36 years old; *Elevation*—600 feet. Shallow, stony, light soil, resting partly on rock and partly on till. Plots of three acres grazed by Cross Hoggs. Experiment begun 1901; Manures applied February 1902. The grazing season extended to twenty weeks in 1901, 1902, 1903, and 1904.

In 1901 each plot was grazed by 4 sheep (May 21 to Oct. 8). On May 17, 1902, 5 sheep were placed on Plots A, B, C, and D, and 4 on Plot O. On June 14, one additional sheep was put on Plots A, B, C, and D. Ten cattle were grazed 36 hours on Plot O and 24 hours on each of the other plots. Grazing ceased Oct. 4. On May 13, 1903, 8 sheep were placed on Plots A, B, C, and D, and 5 on Plot O. On Aug. 5, one sheep was removed from Plots A, B, C, and D, and on Sept 2 another sheep was removed from these plots. Seventeen cattle were grazed for 24 hours on each plot. Grazing ceased Sept. 30. On May 11, 1904, 8 sheep were placed on Plots A, B, C, and D, and 5 on Plot O. On July 6, 1 sheep was removed from Plot C. On Aug 3 another was removed from Plot C, 1 from Plot A, 2 from Plot B, and 4 from Plot D. On Aug. 31, 2 more were removed from Plot A. Seventeen cattle were grazed for 60 hours on each of Plots O and B, 48 hours on Plot D, and 36 hours on Plot C. Grazing ceased Sept 28.

RESULTS PER ACRE.

| Plots | Live-weight increase in 1901 (testing equality of plots) | Treatment per acre | Cost of treatment | | Live weight increase of sheep in | | | | Live weight increase in three years in excess of Plot O | | | Value of cattle grazing Plot O in excess of other plots at 1s per head per week | | Nett gain + or loss − from (b), cattle, and cost. | | Live-weight gain per sheep per week during season | | | | CARRYING POWER. Mean live-weight per acre in | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1902 | 1903 | 1904 | Total | (a) No allowance | (b) Allowing for inequality of plots as shown in 1901 — Weight in lb | Value at 3d per lb | | | | | 1901 | 1902 | 1903 | 1904 | 1901 | 1902 | 1903. | 1904. |
| | lb. | | s. | d | lb | lb. | lb. | lb. | lb. | | s. d. | s | d | s. | d | lb. | lb. | lb. | lb. | lb. | lb. | lb. | lb. |
| A | 27 | Total of 6⅓ cwt. cotton-cake, half decorticated, eaten by sheep in 1902, 1903, and 1904 (=36 lb. nitrogen) | 37 | 4 | 65½ | 84 | 70½ | 220 | 81 | 60 | 15 0 | −2 | 6 | −24 | 10 | 1 01 | 1 70 | 1·70 | 1 47 | 115 | 199 | 182 | 155 |
| B | 23 | 10 cwt basic slag (=200 lb. phosphoric acid) | 22 | 6 | 62 | 86 | 87½ | 235½ | 96½ | 87½ | 21 10½ | −0 | 3 | −0 | 10½ | 86 | 1·61 | 1 74 | 1·82 | 112 | 199 | 184 | 164 |
| C | 23 | 10 cwt. basic slag and 210 lb sulphate of potash (=100 lb potash). | 35 | 9 | 64½ | 93 | 88 | 245½ | 106½ | 97½ | 24 4½ | −1 | 2 | −12 | 6½ | 86 | 1·67 | 1 88 | 1 88 | 112 | 195 | 182 | 165 |
| D | 24 | 9 cwt. superphos. (=200 lb. phos acid) and half ton ground lime | 40 | 7 | 58 | 79 | 75 | 212 | 73 | 61 | 15 3 | −1 | 8 | −27 | 0 | 89 | 1 50 | 1·61 | 1 75 | 113 | 197 | 180 | 141 |
| O | 20 | Untreated . . . | | | 44 | 50 | 45 | 139 | | | | | | | | 76 | 1·64 | 1·52 | 1·35 | 112 | 129 | 121 | 106 |

TABLE VII.—AUCHNASKEOCH. EXPERIMENT conducted by Mr A. CRAWFORD, Auchnaskeoch, Tignabruich, Argyllshire. *Pasture*—50 years old at least, *Elevation*—500 feet Reddish loam mixed with stones, and lying close to rock in points Plots of three acres grazed by one-year-old Blackfaced Wedders Experiment begun 1901; Manures applied February 1902. The grazing season extended to twelve weeks in 1901, and to twenty weeks in 1902, 1903, and 1904.

In 1901 each Plot was grazed by 6 sheep (July 4 to Sept. 26) On May 27, 1902, 8 sheep were placed on Plots A, B, C, and D, and 6 on Plot O. On July 22, 1 sheep was removed from Plot A Grazing ceased Oct. 14. In 1903, 6 sheep were grazed on Plots B, C, D, and 4 on Plots A and O (May 23 to Oct. 10). On May 24, 1904, 6 sheep were placed on Plots B, C, and D, and 4 on Plots A and O. On Aug. 16, 1 sheep was removed from Plots O and D. Grazing ceased Oct. 11.

RESULTS PER ACRE.

| Plots. | Live-weight increase in 1901 (testing equality of plots). | Treatment per acre. | Cost of treatment | Live-weight increase of sheep in | | | | Live-weight increase in three years in excess of mean of Plots A and O | | | Nett gain + or loss − from (b) and cost | Live-weight gain per sheep per week during season | | | | CARRYING POWER. Mean live-weight per acre in | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1902 | 1903 | 1904. | Total | (a) No allowance | (b) Allowing for inequality of plots as shown in 1901: Weight in lb. | (b) Value at 3d per lb | | 1901 * | 1902 | 1903. | 1904 | 1901.* | 1902 | 1903. | 1904. |
| | lb. | | s. d | ʼh. | lb. | lb | lb | lb | | s d. | s. d | lb | lb. | lb. | lb. | lb. | lb. | lb. | lb. |
| A | 41 | Untreated . . . . | | 71 | 47 | 38½ | 156½ | | | | . . | 1 71 | 1·56 | 1·77 | 1·46 | 201 | 208 | 119 | 114 |
| B | 42 | 10 cwt. basic slag (=200 lb. phosphoric acid) | 22 6 | 89 | 75 | 61 | 225 | 72 | 42 | 10 6 | −12 0 | 1 76 | 1·67 | 1·87 | 1·52 | 200 | 235 | 185 | 174 |
| C | 15½ | 10 cwt basic slag and 210 lb sulphate of potash (=100 lb potash) | 35 9 | 85½ | 67 | 33½ | 186 | 33 | 82½ | 20 7½ | −15 1½ | ·65 | 1·60 | 1·68 | ·85 | 189 | 232 | 179 | 159 |
| D | 33½ | 9 cwt. superphos. (=200 lb. phos. acid) and half ton ground lime | 40 7 | 81 | 71 | 51½ | 203½ | 51 | 46½ | 11 7½ | −28 11½ | 1·40 | 1 52 | 1·77 | 1·38 | 197 | 231 | 181 | 160 |
| O | 23 | Untreated . . . . | | 57½ | 51 | 40½ | 149 | | | | | ·97 | 1 44 | 1·90 | 1·70 | 193 | 171 | 120 | 103 |

* Twelve weeks only.

TABLE VIII.—HAY PER ACRE FOR 1901, 1902, 1903, and 1904. Results from Sub-Plots of $\frac{1}{20}$ of an Acre.

*No Manure in* 1901.

In some cases the herbage was weighed as soon as cut, and one-third is taken as hay. In other cases it was weighed as hay. At Holestane, in 1903, the hay was somewhat wet when weighed, and 20 per cent has been deducted from the gross weights.

| Plot. | Manure. | Sunderland Hall. | | | | | Boon | | | | | Naemoor. | | | | | Holestane. | | | | | Hillridge. | | | | | Boreland. | Auchnaskeoch. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1901 | 1902. | 1903 | 1904. | Three years 1902 to 1904 | 1901 | 1902. | 1903 | 1904 | Three years 1902 to 1904 | 1901 | 1902. | 1903 | 1904 | Three years 1902 to 1904 | 1901 | 1902 | 1903 | 1904 | Three years 1902 to 1904 | 1901. | 1902. | 1903. | 1904. | Two years 1902 and 1904 | | |
| | | cwt. | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt. | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt | cwt. | cwt. | | cwt. | cwt. | | |
| A | Ground cake | 10½ | 18½ | 12 | 17 | 47½ | 23½ | 16½ | 19 | 27 | 62½ | 5 | 8 | 32½ | 29 | 69½ | 35 | 20 | 45 | 40 | 105 | 6½ | 13 | Grass on sub-plots so short that it was not worth cutting and weighing | 14¾ | 27¼ | Sub-plots were fenced in, but the produce was always too short to cut | There were no sub-plots in this experiment. |
| B | Slag . . | 7¼ | 23 | 15¼ | 18½ | 56¾ | 20¼ | 14½ | 16 | 25 | 55½ | 5¼ | 10¼ | 38½ | 25¼ | 74 | 48¼ | 16½ | 45 | 42½ | 104 | 5¼ | 13½ | | 30¼ | 43¾ | | |
| C | Slag and potash | 5½ | 20¾ | 20½ | 14½ | 55¾ | 22½ | 16¼ | 17 | *12¼ | | 4½ | 11¼ | 33½ | 29½ | 74¼ | 50 | 21½ | 48 | 42½ | 112 | 9¼ | 12¼ | | 24¼ | 36½ | | |
| D | Superphos. and lime | 12½ | 25½ | 14¼ | 20 | 59¾ | 19¾ | 14 | 16½ | *4 | . | 5 | 9 | 39¼ | 30¾ | 79 | 50 | 26½ | 48 | 40 | 114½ | 14½ | 17¾ | | 18 | 35¾ | | |
| O | No manure | 11¼ | 20¾ | 13¾ | 16½ | 51 | 21¾ | 10¾ | 12½ | *2¾ | | 4¾ | 7½ | 34¼ | 16 | 57¾ | 38¼ | 18¼ | 45 | 40 | 103¼ | 8¾ | 22¼ | | 31¾ | 54 | | |
| X | Bone-meal . | | | | .. | . | | | | | | | | | | | 35¾ | 20 | 48 | 40 | 108 | | | | | . | | |

* These sub-plots were on the portion burned in spring 1904 and produced a thick low growth

## TABLE IX.—Percentage of Carcass in unfasted Live Weight.

Five sheep were weighed fasted before killing, and had lost, with little variation, 7·7 per cent of their unfasted weight. The percentage of carcass to fasted live-weight would therefore be from 3 per cent to 4 per cent above the figures given below.

The sheep at Sunderland Hall and Boon were Cheviots, and Blackfaces at Naemoor and Hillridge.

| Plot | Sunderland Hall | | | Boon. | | | Naemoor | Hillridge | Mean |
|---|---|---|---|---|---|---|---|---|---|
| | 1902. | 1903 | 1904 | 1902 | 1903 | 1904 | 1902 | 1902 | |
| | % | % | % | % | % | % | % | % | % |
| A | 44·6 | 43·7 | 48·4 | 49·5 | 44·2 | 48·1 | 36·3 | 41·8 | 44·6 |
| B | 41·7 | 39·3 | 43·0 | 46·6 | 43·0 | 44·9 | 35·3 | 36·3 | 41·3 |
| C | 42·8 | 40·2 | 39·7 | 44·7 | 42·2 | 45·2 | 37·7 | 38·4 | 41·4 |
| D | 42·6 | 43·8 | 41·7 | 46·0 | 42·7 | 42·4 | 37·2 | 34·9 | 41·4 |
| O | 42·4 | 43·1 | 41·7 | 46·5 | 47·1 | 47·5 | 36·3 | 33·0 | 42·2 |

## TABLE X.—Analyses of Soils and Subsoils. Parts in 100 of air-dried Sample.

The samples were taken by auger, and many cores from different parts of each plot were mixed to form the sample The surface soil was taken to the line of demarcation with the subsoil. The depth, therefore, varied, but never exceeded 9 inches.

**Sunderland Hall**

| | Soils, Plots A | B | C | D | O | Subsoils, Plots A | B | C | D | O |
|---|---|---|---|---|---|---|---|---|---|---|
| Water | 4·70 | 3·95 | 3 40 | 4 82 | 3 70 | 3 35 | 3 00 | 2 67 | 3·72 | 2 70 |
| Stones | 20·34 | 18·15 | 18·55 | 11 89 | 35 38 | 47 31 | 55 14 | 42 68 | 57 23 | 58 14 |
| Gravel | 4·82 | 3·06 | 4 28 | 2 24 | 4 72 | 6·96 | 4·94 | 10 42 | 7 97 | 5 89 |
| Fine soil passing through No 20 wire-cloth | 70·14 | 74 84 | 73 77 | 80·05 | 56 20 | 42 38 | 36·92 | 44 23 | 31·08 | 33·27 |
| | 100·00 | 100·00 | 100·00 | 100·00 | 100 00 | 100 00 | 100 00 | 100 00 | 100 00 | 100·00 |
| **Analyses of Fine Soil—** | | | | | | | | | | |
| Organic matter and combined water | 13 62 | 10·02 | 10 42 | 12 33 | 11 75 | 8 10 | 7 35 | 5 75 | 9·30 | 7 02 |
| Nitrogen | ·420 | 294 | 161 | 371 | 322 | 217 | 182 | 161 | 203 | 161 |
| Soluble in Hydrochloric acid: Phosphoric acid | ·102 | 084 | 078 | ·090 | 093 | 112 | 101 | ·082 | ·109 | ·085 |
| Potash | 193 | 213 | ·224 | 239 | 205 | 194 | 223 | ·258 | 223 | 218 |
| Lime | ·320 | 288 | 494 | 350 | 356 | 140 | 158 | 156 | ·214 | ·296 |
| Magnesia | 238 | 126 | 800 | ·283 | ·416 | 149 | 300 | 176 | 732 | ·265 |
| Ferric oxide | 5 70 | 5 13 | 5 02 | 5 58 | 5 43 | 6 90 | 6 10 | 6 38 | 6 94 | 5·64 |
| Alumina | 1·96 | 2·27 | 3·02 | 2 49 | 2·29 | 2·32 | 3 65 | 2·61 | 3 89 | 3 08 |
| Soluble in Citric acid (Dyer's method): Phosph acid | ·023 | ·019 | ·021 | 018 | ·021 | ·021 | 015 | ·017 | ·022 | ·020 |
| Potash | 024 | 029 | ·023 | ·029 | ·025 | ·025 | ·029 | ·026 | 029 | ·025 |

**Boon.**

| | Soils, Plots A | C | O | Subsoils, Plots B | D | O |
|---|---|---|---|---|---|---|
| Water | 5·68 | 7·60 | 4 83 | 1·97 | 2 00 | 1·90 |
| Stones | 7 15 | 7 94 | 32·99 | 48 11 | 52 42 | 35 09 |
| Gravel | 7 28 | 6 15 | 4 72 | 6 49 | 6 90 | 6 42 |
| Fine soil passing through No 20 wire-cloth | 79 89 | 78 31 | 57 46 | 43 43 | 38 68 | 56 59 |
| | 100 00 | 100 00 | 100 00 | 100 00 | 100 00 | 100 00 |
| **Analyses of Fine Soil—** | | | | | | |
| Organic matter and combined water | 19·82 | 24 95 | 14 42 | 6 43 | 6 12 | 5 80 |
| Nitrogen | 448 | 595 | 367 | 126 | 147 | 119 |
| Soluble in Hydrochloric acid: Phosphoric acid | ·058 | 063 | 052 | 033 | ·031 | ·043 |
| Potash | 058 | 038 | 041 | 133 | 039 | 151 |
| Lime | 041 | ·041 | ·055 | 029 | ·036 | ·104 |
| Magnesia | 019 | 013 | 007 | 008 | ·007 | ·007 |
| Ferric oxide | 581 | 461 | ·586 | 1 79 | 1 75 | 2 92 |
| Alumina | 404 | 339 | ·454 | 1·00 | 1 17 | 1 27 |
| Soluble in Citric acid (Dyer's method): Phosph acid | 032 | ·028 | 022 | ·032 | ·020 | 017 |
| Potash | 007 | 018 | 015 | 015 | 020 | ·042 |

**Narmoor.**

| | Soils, Plots A | C | O | Subsoils, Plots A | C | O |
|---|---|---|---|---|---|---|
| Water | 5 82 | 4 60 | 7·22 | 3 75 | 3·95 | 6·25 |
| Stones | 24 13 | 18 26 | 20·43 | 35 38 | 27·27 | 35·26 |
| Gravel | 8 19 | 6 54 | 9·34 | 9 01 | 9·95 | 7·19 |
| Fine soil passing through No 20 wire-cloth | 61 86 | 70 60 | 63·01 | 51·86 | 58·83 | 51·30 |
| | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 |
| **Analyses of Fine Soil—** | | | | | | |
| Organic matter and combined water | 16 40 | 11·55 | 24·08 | 7 53 | 7·25 | 11·37 |
| Nitrogen | 549 | ·329 | ·625 | ·173 | ·128 | ·259 |
| Soluble in Hydrochloric acid: Phosphoric acid | 075 | 076 | 079 | ·083 | ·095 | ·094 |
| Potash | 033 | ·071 | ·055 | ·017 | ·015 | ·014 |
| Lime | ·029 | ·038 | ·041 | ·109 | ·114 | ·096 |
| Magnesia | ·035 | ·018 | 025 | ·660 | ·108 | ·486 |
| Ferric oxide | 2 77 | 4 27 | 2·58 | 3 97 | 5 12 | 3·84 |
| Alumina | 2 31 | 2·08 | 2·36 | 2·50 | 2 70 | 3·60 |
| Soluble in Citric acid (Dyer's method): Phosph acid | ·042 | ·042 | ·061 | ·066 | ·059 | ·072 |
| Potash | 020 | ·029 | ·023 | ·014 | ·012 | ·013 |

The analyses of the west country soils are not yet completed

# MILK INVESTIGATIONS AT GARFORTH, 1904.

By CHARLES CROWTHER, M.A., Ph.D.,
Lecturer in Agricultural Chemistry in the University of Leeds.

THE experiments described in the present communication were carried out at the Garforth Experimental Farm of the University of Leeds and the Yorkshire Council for Agricultural Education during the summer of 1904.

Experiments of a similar nature had previously been carried out there in the years 1900-1902 by Mr Herbert Ingle, F.I.C., and in 1903 by the present writer, all of which have been fully reported in previous volumes of the 'Transactions.'[1] The chief results of these experiments are summarised in vol. xvi. pp. 268-306, and it is therefore unnecessary to repeat more than is requisite for the purposes of the present communication.

Throughout the experiments it has been found that at Garforth there is a striking difference in the yield and quality of the milk obtained at the two milkings which take place daily, the morning milk being invariably considerably greater in quantity and relatively much poorer in fat than that obtained at the afternoon milking.

It has further been demonstrated[2] that the difference is to be ascribed *mainly, if not entirely*, to the marked inequality of the intervals between successive milkings — the usual hours at which milking commences at Garforth being 6 A.M. and 3.30 P.M.

*These and other experiments*[3] *have indeed shown it to be highly probable that such a marked difference between the morning and afternoon milkings ought only to be general where marked inequalities in the intervals between milkings obtain.*

With a view to determining the possibility or otherwise of raising the fat-content of the morning milk, whilst retaining the unequal intervals—to alter which is in so many cases, for trade and other reasons, highly inexpedient, if not impracticable —the influence of various factors on the milk-secretion has been studied in the course of the experiments.

Although no very marked improvement has in any case been

[1] Trans., 5th ser., 1901, vol. xiii. p. 218; 1902, vol. xiv. p. 284; 1903, vol. xv. p. 135; 1904, vol xvi p. 268.

[2] Ingle, Trans., 1903, vol. xv. pp. 140-153.

[3] Cambridge Univ. Dep. of Agriculture, 5th Ann. Rep., pp. 92-101; Univ. Coll. Reading, 9th Ann Rep., pp. 5 12.

recorded, it has appeared probable, from the experiments carried out by Mr Ingle in 1901-1902, repeated with some modifications by the author in 1903, that a slight improvement of the morning milk in respect of fat may be effected where such conditions do not already obtain—(*a*) by supplying concentrated highly nitrogenous food liberally;[1] (*b*) by supplying this food at the morning milking only.[2] In the previous experiments these changes were investigated separately.

The *object of the experiments* described in the present paper was to investigate the *combined* effect of a simultaneous change in respect of *both* the above factors, as brought about by substituting decorticated cotton-cake—a highly nitrogenous food—given in the morning only, for the same weight of maize-meal—a food poor in nitrogenous constituents—given morning and evening.

Further, it was felt that, in view of the great daily fluctuations in the quality of the milk from each cow and the marked differences between individual cows in this respect, the scope of the experiments should be more restricted than in previous years, in order that a greater number of cows might be subjected to the change under investigation. It was hoped that thereby the mean results would become a more reliable indication of the nature and magnitude of the effects produced, in that they would not be so markedly influenced by any exceptional deviation from the mean in the case of individual cows as was occasionally observed in the previous experiments (cf. 'Transactions,' 1904, vol. xvi. p. 284).

The investigations commenced with the morning milk of June 7 and ended with the evening milk of September 9,—thus extending over a period of 95 days, and comprising analyses of more than 2800 separate samples.

The *methods of sampling and analysis*[3] were precisely those employed in the previous two years, and fully described in the 'Transactions' for 1903, pp. 137, 139.

The analyses were carried out at the farm, each day's work comprising the morning samples of the day, and those taken at the previous evening milking.

With very few exceptions the cows were always milked by the regular milkers—three in number—and care was taken in every case to ensure that the udder was carefully "stripped" before the milk was mixed and sampled.

A careful record was kept of the time at which each cow was milked (actually the time at which the milk was weighed), and the particular milker employed. In this way a satisfactory

[1] Trans., 1902, vol. xiv. p. 295; 1904, vol. xvi. p. 305.

[2] Trans., 1903, vol. xv. p. 173; 1904, vol. xvi. p. 282.

[3] My thanks are due to Mr P. Snowdon for valued assistance in the sampling.

check on the constancy of the intervals between milkings and on the efficiency of the milker was established.

For several weeks previous to the commencement, and throughout the whole period of the experiment, the cows were at pasture day and night, with the exception of Nos. 5, 10, 14, and 23, which from August 20 onwards were at pasture only between the morning and afternoon milkings.

The milkings were performed in the cow-house, commencing usually at about 6 A.M. and 3.30 P.M. daily.

As in the 1903 experiments, notes were made of the weather and of any changes of pasture and abnormalities in the health or disposition during milking of any cow, and especially of periods of sexual excitement.

## *Plan of Investigations.*

For the purpose of the investigations 14 cows were selected from the herd, all of them having for several weeks previous to the commencement of sampling on June 7 received precisely the same treatment, in that they were at pasture day and night, and received daily per head a mixture of

2 lb undecorticated cotton-cake,
3 lb. maize-meal,

half being given at the morning milking and the other half at night. From the data given in the footnote,[1] which represent the average composition of the foods used in the experiment, it will be seen that this ration is essentially poor in nitrogenous constituents, supplying per head only about ½ lb. of digestible albuminoids daily, whereas, if commonly adopted standards may be trusted, the grazing of pastures of the quality of those at Garforth requires to be supplemented by probably twice this amount of albuminoids during the summer months.[2]

It is indeed identical with the "ration poor in albuminoids" employed in the 1903 experiments.

No change was made in the treatment of the cows during the first 28 days of the experiment, in order that the results obtained in this period might serve as standards with which to compare the results obtained in the subsequent stages of the experiment.

| | Digestible protein per cent. | Digestible "carbohydrates" per cent. | Digestible fat per cent. |
|---|---|---|---|
| [1] Maize-meal . . . . | 7 5 | 66·5 | 4·3 |
| Undecorticated cotton-cake . | 16·5 | 17·5 | 5·5 |
| Decorticated cotton-cake . | 36· | 16·5 | 12·5 |

[2] Cf. Journal of the Board of Agriculture, vol. ix. p. 150 (Sept. 1902).

The general course of the experiment is shown in the following schedule:—

PERIOD I. (June 7 to July 4) (28 days).

All cows received daily—

2 lb. undecorticated cotton-cake } half in the morning and half at night.
3 lb. maize-meal . . . }

At the evening milking on July 4 the cows were divided into two groups of 7 cows each.

PERIOD II. (July 5 to August 1) (28 days).

*Control Group* (Nos. 2, 5, 6, 8, 9, 14, 17).

Received the same treatment as before, and continued to do so throughout the whole of the experiment.

*Test Group* (Nos. 7, 10, 12, 15, 16, 19, 23).

Received daily—

2 lb. undecorticated cotton-cake } all at the *morning* milking.
3 lb. *decorticated cotton-cake* . }

PERIOD III. (August 2 to 20) (19 days).

*Control Group.*

No change in treatment.

*Test Group.*

From August 1 received daily—

2 lb. undecorticated cotton-cake } all at the *morning* milking.
3 lb. *maize-meal* . . . }

PERIOD IV. (August 21 to September 9) (20 days).

*All* cows received exactly same treatment as in first period.

In brief, the double change of treatment was introduced with the "Test Group" of 7 cows at the end of Period I., and after four weeks (Period II.) a gradual return to the original conditions was made—viz., at the end of Period II. to the original ration, the changed mode of feeding being, however, retained, and finally, after a further period of 19 days (Period III.), the original conditions were restored in this respect also, and the sampling continued for 20 days longer (Period IV.).

The remaining 7 cows—the "Control Group"—on the other hand, received exactly the same treatment throughout the whole of the experiment, and hence the changes recorded by this group are assumed to represent the normal changes taking place in the quantity and quality of the milk-secretion, due to advance of lactation, climatic and other influences, which are assumed to affect all the cows alike. There is undoubtedly considerable risk of error in making such an assumption, but from the number of cows in each group and the marked similarity in the results obtained with the two groups during Period I. (cf. figs. 56 and 57, pp. 331, 332) when they received identical treatment, the assumption would appear to be fairly justifiable in reference to the present experiment (see further, p. 304).

From the figures given in the footnote on p. 298, it will be seen that the ration of undecorticated and decorticated cotton-cake supplied to the Test Group during Period II. was much richer in albuminoids than the ration containing maize otherwise employed throughout the experiment, and received without intermission during the whole of the experiment by the Control Group. The former ration, indeed, supplied daily per head nearly 1½ lb. of digestible albuminoids, as contrasted with the ½ lb. supplied by the latter.

In forming the two groups, the endeavour was made to secure that they should be as nearly as possible alike in all respects, and particularly with respect to the periods of lactation and the general milking qualities of the individual members. The degree of success which attended this effort will be seen from the following tables (Tables I. (A) and I. (B)), which give various particulars requisite for a full comparison of the two groups,—the arrangement of the individual members in the tables being designed to bring cows which were regarded as being most nearly comparable for the purpose of the experiment into corresponding positions in the two tables:—

TABLE I. (A)—CONTROL GROUP.

| No. of cow | Age | Weight on July 4. | Weeks since calving, to June 7 | Daily average for Period I. Milk yield | Fat | Date when last served, before or during experiment |
|---|---|---|---|---|---|---|
| | Years | cwt qr lb | | lb | Per cent. | |
| 2 | 4 | 11 1 6 | 3 | 44·5 | 3·51 | July 18 |
| 5 | 6 | 11 1 12 | 14 | 27·1 | 3·58 | May 7 |
| 6 | 5 | 11 0 16 | 21 | 27·0 | 3·95 | " 19 |
| 8 | 6 | 11 3 0 | 5 | 36·1 | 3·21 | July 16 |
| 9 | 5 | 12 3 0 | 9 | 35·4 | 3 13 | May 31 |
| 14 | 6 | 12 2 2 | 4 | 44 8 | 3·28 | July 3 |
| 17 | 7 | 10 3 16 | 9 | 35 4 | 2·63 | May 30 |
| Mean | 5·6 | 11 2 19 | 9·3 | 35·8 | 3·31 | |

(B)—TEST GROUP

| No. of cow | Age | Weight on July 4. | Weeks since calving, to June 7 | Milk yield | Fat | Date when last served, before or during experiment |
|---|---|---|---|---|---|---|
| 19 | 6 | 10 0 16 | 8 | 40·3 | 3·30 | July 24 |
| 16 | 5 | 10 0 8 | 9 | 33 2 | 3·81 | Aug. 26 |
| 10 | 5 | 11 2 20 | 21 | 25·2 | 3·51 | May 24 |
| 7 | 6 | 11 3 0 | 13 | 38·6 | 3·36 | June 15 |
| 12 | 6 | 10 1 18 | 6 | 35·7 | 3·14 | Aug. 2 |
| 23 | 6 | 11 1 0 | 9 | 43·8 | 3·32 | July 23 |
| 15 | 6 | 10 3 20 | 11 | 36·3 | 3·00 | June 9 |
| Mean | 5·7 | 10 3 16 | 11 | 36·2 | 3·33 | |

It will be noted that there is a close agreement all round between the two groups, the greatest difference being in the average weights, the cows of the Test Group being in nearly every case rather smaller than those of the Control Group.

With the exception of Nos. 6, 10, and 16, they were the same cows as were employed in the 1903 experiments.

The data obtained from the analyses are summarised in Tables II., III., pp. 302, 303, XI.-XXV., pp. 333-347, in which are given the mean daily results obtained during successive short intervals, Periods I. and II. being each divided into four weeks, Period III. into three intervals of 5, 7, and 7 days respectively, and Period IV. into three intervals of 5, 7, and 8 days respectively. In addition the mean daily results for the whole of each period are given.[1]

The results are presented in this abbreviated form in order to avoid too tedious an array of figures. The maximum variation recorded in any one of the intervals, for which mean results are given, are recorded for each cow separately in Table XXVII., p. 349. It will be seen that the daily fluctuations in the composition of the milk were quite as pronounced as in previous years. Appended to this table are also the maximum and minimum values found during the experiment for the percentage of fat, solids-not-fat, and total solids respectively, and also for the specific gravity.

The data concerning the mixed morning and evening milk given in the tables are calculated from the results obtained separately with the morning and evening samples each day. It has often been observed that when cows are milked regularly at equal intervals there is no great difference in the quality of the morning and evening milk, and hence the data referred to may be taken as representing approximately what probably would have been the composition of the milk at each milking if the intervals had been equal.

In order to facilitate the necessary comparison of the data yielded by the two groups, the weekly means for yield, percentage of fat, and of solids-not-fat, are represented graphically in figs. 56 and 57, pp. 331, 332. For rapid identification the points representing the means are surrounded by small circles, a double circle indicating that the means for the two groups were identical for this particular week. These points are further connected together by straight lines in order that the fluctuations can be more conveniently traced. The inference must not be made, however, that the changes from week to week are of the order of regularity implied in the continuous curves thereby formed.

[1] In compiling these tables a few obviously abnormal results, attributable in practically every case to sexual excitement, have been omitted.

## TABLE II.—CONTROL GROUP. (Nos. 2, 5, 6, 8, 9, 14, 17.)

AVERAGE WEIGHT PER COW on July 4, 11 cwt 2 qr. 19 lb.; Aug. 2, 11 cwt. 2 qr. 25 lb.; Sept. 12, 11 cwt 3 qr. 6 lb.

MEAN DAILY RESULTS

| PERIOD. | Milk yield | | Fat | | Solids-not-fat. | | Total weight of fat | | Total weight of solids-not-fat | | Mixed morning and evening milk | | | FOOD, ETC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.-N.-F. | |
| | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. June 7–June 13 | 156·0 | 111·5 | 2·81 | 4·06 | 9·06 | 9·01 | 4·266 | 4·666 | 14·110 | 10·031 | 267·5 | 3·34 | 9·03 | Received daily— 2 lb. undec. cotton-cake, 3 " maize-meal, given morn. and night. At pasture day and night. |
| " 14– " 20 | 149·0 | 107·5 | 2·78 | 4·08 | 8·94 | 9·03 | 4·009 | 4·391 | 13·311 | 9·603 | 256·5 | 3·28 | 8·97 | |
| " 21– " 27 | 143·0 | 103·5 | 2·82 | 4·14 | 8·95 | 8·90 | 3·985 | 4·261 | 12·753 | 9·191 | 246·0 | 3·35 | 8·92 | |
| " 28–July 4 | 138·5 | 95·5 | 2·90 | 3·88 | 8·99 | 8·91 | 3·983 | 3·701 | 12·461 | 8·505 | 234·0 | 3·28 | 8·96 | |
| **Mean results for first period** | **146·2** | **104·0** | **2·81** | **4·05** | **8·98** | **8·94** | **4·042** | **4·231** | **13·127** | **9·285** | **250·2** | **3·31** | **8·96** | RATIO, A.M. : P.M. { Yield, 1·40 : 1. Fat, %, 1 : 1·44. |
| II. July 5–July 11 | 133·0 | 94·0 | 2·81 | 3·98 | 9·03 | 8·87 | 3·669 | 3·750 | 11·993 | 8·339 | 227·0 | 3·27 | 8·96 | Received daily— Stall food as in Period I. At pasture day and night. |
| " 12– " 18 | 127·0 | 87·5 | 2·83 | 4·23 | 8·95 | 8·79 | 3·523 | 3·718 | 11·326 | 7·695 | 214·5 | 3·38 | 8·87 | |
| " 19– " 25 | 124·0 | 85·0 | 2·79 | 4·10 | 8·98 | 8·83 | 3·397 | 3·473 | 11·142 | 7·508 | 209·0 | 3·29 | 8·92 | |
| " 26–Aug 1 | 121·5 | 82·5 | 2·90 | 4·22 | 8·83 | 8·68 | 3·478 | 3·491 | 10·696 | 7·155 | 204·0 | 3·42 | 8·75 | |
| **Mean results for second period** | **126·3** | **87·3** | **2·83** | **4·13** | **8·95** | **8·79** | **3·515** | **3·606** | **11·286** | **7·671** | **213·6** | **3·33** | **8·88** | RATIO, A.M. : P.M. { Yield, 1·45 : 1. Fat, %, 1 : 1·46. |
| III. Aug 2–Aug. 6 | 115·0 | 82·0 | 3·02 | 4·14 | 8·90 | 8·70 | 3·424 | 3·393 | 10·206 | 7·131 | 197·0 | 3·46 | 8·80 | Received daily— Stall food as in Period I. At pasture day and night. |
| " 7– " 13 | 116·5 | 76·0 | 3·09 | 4·26 | 8·88 | 8·75 | 3·555 | 3·255 | 10·315 | 6·670 | 192·5 | 3·54 | 8·82 | |
| " 14– " 20 | 113·0 | 72·0 | 2·93 | 4·31 | 8·78 | 8·87 | 3·277 | 3·108 | 9·921 | 6·370 | 185·5 | 3·44 | 8·82 | |
| **Mean results for third period** | **114·8** | **75·8** | **3·01** | **4·25** | **8·84** | **8·79** | **3·419** | **3·227** | **10·133** | **6·658** | **190·6** | **3·49** | **8·81** | RATIO, A.M. : P.M. { Yield, 1·52 : 1. Fat, %, 1 : 1·41. |
| IV. Aug 21–Aug. 25 | 105·0 | 68·5 | 3·21 | 4·29 | 8·89 | 8·74 | 3·304 | 2·936 | 9·289 | 5·975 | 173·5 | 3·60 | 8·80 | Received daily— Stall food as in Period I. At pasture day and night. |
| " 26–Sept. 1 | 100·0 | 65·5 | 3·25 | 4·37 | 8·81 | 8·62 | 3·208 | 2·836 | 8·809 | 5·618 | 165·5 | 3·65 | 8·72 | |
| Sept. 2– " 9 | 92·5 | 58·5 | 3·43 | 4·46 | 8·72 | 8·51 | 3·129 | 2·601 | 8·043 | 4·979 | 151·0 | 3·80 | 8·62 | |
| **Mean results for fourth period** | **98·3** | **63·3** | **3·31** | **4·39** | **8·80** | **8·62** | **3·201** | **2·763** | **8·627** | **5·449** | **161·6** | **3·69** | **8·71** | RATIO, A.M. : P.M. { Yield, 1·55 : 1. Fat, %, 1 : 1·33. |

## TABLE III.—TEST GROUP. (Nos. 7, 10, 12, 15, 16, 19, 23.)

AVERAGE WEIGHT PER COW on July 4, 10 cwt. 3 qr. 16 lb.; Aug. 2, 10 cwt. 3 qr. 6 lb.; Sept. 12, 10 cwt. 3 qr. 3 lb.

MEAN DAILY RESULTS.

| PERIOD. | | Milk yield | | Fat. | | Solids-not-fat. | | Total *weight* of fat | | Total *weight* of solids-not-fat | | Mixed morning and evening milk. | | | FOOD, ETC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.-N.-F | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 155·5 | 114·0 | 2·81 | 4·03 | 9·06 | 9·01 | 4·351 | 4·765 | 13·978 | 10·248 | 269·5 | 3·39 | 9·03 | Received daily— |
| | " 14– " 20 | 149·5 | 110·0 | 2·77 | 4·04 | 8·97 | 9·03 | 4·052 | 4·455 | 13·397 | 9·964 | 259·5 | 3·28 | 9·00 | 2 lb. undec. cotton-cake } given morn. |
| | " 21– " 27 | 142·0 | 106·5 | 2·81 | 4·16 | 9·00 | 8·95 | 3·909 | 4·415 | 12·774 | 9·499 | 248·5 | 3·35 | 8·97 | 3 " maize-meal } and night. |
| | " 28–July 4 | 136·0 | 101·0 | 2·87 | 3·96 | 9·02 | 9·00 | 3·857 | 4·016 | 12·252 | 9·068 | 236·5 | 3·33 | 9·01 | At pasture day and night. |
| Mean results for first period | | **145·4** | **107·8** | **2·81** | **4·04** | **8·99** | **8·99** | **4·030** | **4·399** | **13·068** | **9·680** | **253·2** | **3·33** | **8·99** | RATIO, A.M. : P.M. { Yield, 1·35 : 1.<br>Fat, %, 1 : 1·44. |
| II. | July 5–July 11 | 135·0 | 100·0 | 2·86 | 4·12 | 9·09 | 8·96 | 3·828 | 4·141 | 12·245 | 8·961 | 235·0 | 3·39 | 9·03 | Received daily— |
| | " 12– " 18 | 125·5 | 92·0 | 2·80 | 4·04 | 8·98 | 8·87 | 3·488 | 3·752 | 11·258 | 8·165 | 217·5 | 3·33 | 8·93 | 2 lb. undec. cotton-cake } all at *morn-* |
| | " 19– " 25 | 118·5 | 86·0 | 2·83 | 4·25 | 9·07 | 8·87 | 3·345 | 3·679 | 10·728 | 7·609 | 204·5 | 3·43 | 8·97 | 3 " decort. " " } *ing* milking. |
| | " 26–Aug. 1 | 118·5 | 83·5 | 2·87 | 4·19 | 8·89 | 8·68 | 3·408 | 3·505 | 10·545 | 7·226 | 202·0 | 3·42 | 8·79 | At pasture day and night. |
| Mean results for second period | | **124·4** | **90·4** | **2·83** | **4·16** | **9·00** | **8·85** | **3·509** | **3·775** | **11·193** | **7·992** | **214·8** | **3·39** | **8·93** | RATIO, A.M. : P.M. { Yield, 1·38 : 1.<br>Fat, %, 1 : 1·47. |
| III. | Aug. 2–Aug. 6 | 114·0 | 82·5 | 2·85 | 4·02 | 8·90 | 8·70 | 3·231 | 3·214 | 10·153 | 7·242 | 196·5 | 3·33 | 8·80 | Received daily— |
| | " 7– " 13 | 116·0 | 72·5 | 3·07 | 4·11 | 8·78 | 8·70 | 3·548 | 2·995 | 10·177 | 6·282 | 188·0 | 3·48 | 8·75 | 2 lb. undec. cotton-cake } *all at morn-* |
| | " 14– " 20 | 110·0 | 70·5 | 3·00 | 4·24 | 8·75 | 8·86 | 3·305 | 3·005 | 9·621 | 6·253 | 180·5 | 3·50 | 8·81 | 3 " maize-meal } *ing milking.*<br>At pasture day and night |
| Mean results for third period | | **112·9** | **74·2** | **2·98** | **4·13** | **8·80** | **8·77** | **3·361** | **3·081** | **9·957** | **6·521** | **187·1** | **3·44** | **8·79** | RATIO, A.M. : P.M. { Yield, 1·52 : 1.<br>Fat, %, 1 : 1·39. |
| IV. | Aug 21–Aug. 25 | 100·0 | 69·0 | 3·13 | 4·25 | 8·78 | 8·75 | 3·134 | 2·930 | 8·785 | 6·031 | 168·5 | 3·60 | 8·77 | Received daily— |
| | " 26–Sept. 1 | 95·0 | 67·5 | 3·20 | 4·40 | 8·72 | 8·57 | 3·065 | 3·012 | 8·297 | 5·801 | 163·0 | 3·73 | 8·65 | Stall food as in Period I. |
| | " 2– " 9 | 88·0 | 57·0 | 3·31 | 4·36 | 8·60 | 8·37 | 2·929 | 2·525 | 7·587 | 4·817 | 145·5 | 3·75 | 8·49 | At pasture day and night. |
| Mean results for fourth period | | **93·5** | **63·8** | **3·23** | **4·35** | **8·70** | **8·56** | **3·027** | **2·800** | **8·144** | **5·470** | **157·3** | **3·70** | **8·65** | RATIO, A.M. : P.M. { Yield, 1·47 : 1.<br>Fat, %, 1 : 1·35. |

## DISCUSSION OF RESULTS.

For the purpose of arriving at the effects of the changes introduced in the treatment of the cows of the Test Group after the close of Period I., the assumption is made, as already indicated (p. 299), that if no such changes had been made there would have been an *exact* analogy between the fluctuations of yield and quality observed from day to day with both groups. A comparison (*vide* figs. 56 and 57, pp. 331, 332) of the weekly means for both groups during Period I., when all the cows received precisely the same treatment, suggests that this assumption is most strictly true in the case of the milk-*yields*, whilst in the case of the percentages of fat and of solids-not-fat respectively, although as a rule the changes from week to week are in the same *direction* in the case of both groups, they are not strictly proportional in magnitude.[1] These deviations must therefore be borne in mind in discussing the changes in the quality of the milk from week to week.

In the previous communications the conclusions as to the effects of the changes investigated have been based mainly on the variations from period to period in the mean values for the different *groups* of cows. In this way the results of the experiment from the practical standpoint are, of course, arrived at, but these results are not necessarily a fair indication of the nature of the effects which have been produced *in the case of each individual cow*. It is well known that the magnitude of the effects produced varies considerably with different cows (cf. 'Transactions,' 1904, p. 284), and hence there is always a possibility that the indications of the group means may be quite misleading, owing to an actual *minority* of the members of the group recording changes of unusual magnitude, and opposite in direction to those recorded by the majority.

Further, the group means for the *whole* period during which the changes of treatment under investigation are continued do not indicate any variations in the effects which may have taken place at different times during the period, such as will have occurred if the effects have been pronouncedly temporary in character.

More reliable conclusions and more precise information may, therefore, be expected if, in addition to the indications of the group means for the whole period, the indications of the means for successive short intervals throughout the period, and those for the individual cows, be systematically taken into account.

[1] This is partly accounted for—in the case of the fat, at least—by the fact that the weekly means are based on data relatively few in number, and hence, considering the great variations amongst the individual values (cf. Table XXVII., p. 349), may be subject to appreciable errors.

For the purpose of the discussion of the data of the present experiment on these lines special tables (Tables IV.–IX., pp. 306, 310, 313, 316, 320, 322) have been drawn up for Periods II., III., and IV. respectively, giving in each case the means for the period for each group and each individual cow, also the corresponding means for the immediately preceding period, and, further, also the differences between these two means in each case. In the case of the milk-yields, the differences are given as *percentage* decreases of the mean for the earlier period, but in all other cases they are arrived at in each case by simple subtraction of the two mean percentages, the customary distinction between increases (+) and decreases (−) being made by use of the conventional algebraic signs.

To facilitate comparison the cows in each group are arranged in the tables according to the magnitude of the differences recorded. The fluctuations in the weekly means are discussed with the aid of the diagrams (figs. 56 and 57, pp. 331, 332), in which these means are graphically recorded.

From considerations of space the detailed discussion is limited to the data for milk-yield and percentages of fat and of solids-not-fat—although further data are given in the full tables of records (pp. 302, 303, 333-347).

In order to simplify the discussion as far as possible the morning and evening results are treated separately.

## PERIOD II.—Combined Effect of Simultaneous Changes in Nature of Food and Time of Feeding.

### MORNING MILK.

Table IV. (p. 306) contains the data requisite for the discussion of the changes in the amount and quality of the milk yielded at the morning milking during the four weeks subsequent to the introduction at the close of Period I., of changes in the treatment of the Test Group cows, in respect both of the nature of the food and the times of giving it (cf. p. 299).

#### *Yield.*

From the differences recorded in Table IV. (*a*), p. 306, it will be noted that the total morning yield of the Test Group showed during Period II. a decrease proportionately somewhat greater than that of the total yield of the Control Group, but it may further be seen that this was almost entirely attributable to the exceptionally high decrease recorded by Cow No. 12. The other members of the group showed indeed, on the whole, rather *smaller* decreases than the individual members of the

## TABLE IV.—Comparison of Periods I. and II.

### Morning Milk.

#### (a) YIELD.

| Control Group | | | | Test Group. | | | |
|---|---|---|---|---|---|---|---|
| Cow No | Mean for Period I. | Mean for Period II. | Difference | Cow No | Mean for Period I. | Mean for Period II. | Difference. |
| | lb | lb | Per cent | | lb. | lb. | Per cent. |
| 14 | 25·5 | 21 2 | −16·9 | 12 | 20·9 | 16·1 | −23·0 |
| 8 | 21·3 | 17·7 | −16·9 | 15 | 21·1 | 17·8 | −15·6 |
| 17 | 21·2 | 17·9 | −15·6 | 19 | 22·7 | 19·3 | −15·0 |
| 5 | 15·7 | 13 3 | −15·3 | 16 | 19·0 | 16·2 | −14 7 |
| 9 | 20·6 | 18·3 | −11·2 | 7 | 21·1 | 18·4 | −12·8 |
| 6 | 15·7 | 14·1 | −10·2 | 23 | 25·3 | 22·5 | −11·1 |
| 2 | 26 2 | 23·8 | − 9·1 | 10 | 15·3 | 14·1 | − 7·8 |
| Mean for group | 146·2 | 126·3 | −13·6 | ... | 145·4 | 124·4 | −14·4 |

#### (b) PERCENTAGE OF FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent. | Per cent | | Per cent | Per cent | Per cent |
| 2 | 2·82 | 2·72 | −0·10 | 16 | 3·32 | 3 05 | − 0·27 |
| 14 | 2·64 | 2·62 | −0·02 | 12 | 2·64 | 2·51 | −0·13 |
| 8 | 2 72 | 2·71 | −0·01 | 15 | 2·44 | 2·45 | +0·01 |
| 5 | 3·16 | 3 20 | +0·04 | 7 | 2 74 | 2·79 | +0·05 |
| 9 | 2 64 | 2·69 | +0·05 | 10 | 3·30 | 3·41 | +0·11 |
| 6 | 3 58 | 3·66 | +0·08 | 23 | 2 50 | 2·67 | +0·17 |
| 17 | 2 11 | 2·21 | +0·10 | 19 | 2·71 | 2 95 | +0·24 |
| Mean for group | 2·81 | 2·83 | +0·02 | ... | 2·81 | 2·83 | +0·02 |

#### (c) PERCENTAGE OF SOLIDS NOT FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | | Per cent | Per cent | Per cent |
| 2 | 9·01 | 8·83 | −0·18 | 7 | 9 10 | 8·99 | −0·11 |
| 17 | 9·05 | 8·88 | −0·17 | 16 | 9 41 | 9·35 | −0·06 |
| 6 | 9·13 | 9·12 | −0·01 | 23 | 8 93 | 8·88 | −0·05 |
| 5 | 8·96 | 8·97 | +0·01 | 12 | 8·81 | 8 77 | −0·04 |
| 14 | 8·89 | 8·91 | +0·02 | 19 | 8 96 | 9·00 | +0·04 |
| 8 | 8·89 | 9·03 | +0·04 | 15 | 8·84 | 8·95 | +0·11 |
| 9 | 8·83 | 8·88 | +0·05 | 10 | 8·90 | 9·09 | +0·19 |
| Mean for group | 8·98 | 8·95 | −0·03 | ... | 8·99 | 9·00 | +0·01 |

Control Group—the average decrease for the six cows being only 12·8 per cent. The conclusion indicated by the majority of the cows is thus, that the effect of the changes investigated on the yield of milk at the morning milking was to produce a slight *increase* as compared with the Control Group, an increase so slight, however, that it was more than neutralised by the exceptional falling off in the case of one cow.

Further light on the question is gained by a comparison of the weekly means, which may be made very conveniently by means of the graphic record of these data in fig. 56, p. 331. This comparison reveals that the rise in the yield of the Test Group, relative to the yield of the Control Group, was pronounced only in the first week of Period II.—the mean for the Test Group for this week being indeed actually higher than that of the Control Group—a phenomenon never again recorded throughout the subsequent course of the experiment. It may be seen further that during the second and third weeks of the period, the yield of the Test Group fell off at a decidedly more rapid rate than that of the Control Group,[1] whilst the means for the fourth week apparently indicate a return to more normal conditions.

It would appear, therefore, that the changes introduced in the treatment of the Test Group cows at the end of Period I. produced first a slight improvement of the morning yield relative to that of the Control Group, but that after a few days a reaction set in, this in turn soon becoming less pronounced, until towards the end of the period the effects had apparently quite disappeared.

The changes were, however, in every case slight, the greatest difference in the fluctuations of the weekly means being the virtual rise of 3·3 per cent (*i.e.*, 3·3 lb. per 100 lb. total yield per day) in the first week.

### *Percentage of Fat.*

From the data recorded in Table IV. (*b*), p. 306, it will be noted that the mean percentage of fat in the morning milk in the case of both groups rose from 2·81 per cent in Period I. to a mean of 2·83 per cent in Period II., so that the practical effect of the changes in treatment, taking the whole period into account, was in this respect absolutely nil.

A comparison, however, of the records of the individual cows in each group again illustrates the unreliability of conclusions based solely on the group means for the whole period.

[1] The falling off in the second week is exaggerated in that the exceptional *decrease* in the case of No. 12 (cf. p. 305) was mainly recorded in this week (cf. Table XVIII., p. 340).

In the first place, it will be noted that during Period II. five cows gave milk actually poorer in fat, on the average, than that yielded by them during Period I.—viz., Nos. 2, 8, and 14 (Control Group), and Nos. 12 and 16 (Test Group).

Except in the case of No. 16, the falling off is readily explained by the fact that these cows were in the very earliest stages of lactation at the commencement of the experiment (*vide* Table I., p. 300). It is well known that shortly after calving the milk of the cow in most cases shows for a time such a falling off, and later a steady improvement with respect to its fat-content.

This explanation cannot be applied in the case of No. 16, for it will be seen from the records for this cow (Table XXI., p. 343) that the falling off was particularly noticeable in Period II. *only*, and it is obvious that the conditions during this period were in some way unsuited to this animal, the improvement after the restoration of the original conditions being quite marked.

If the data for No. 16 be omitted, the means for the Test Group for the Periods I. and II. become 2·72 and 2·80 per cent respectively, and the slight improvement, as compared with the Control Group, thereby indicated is more in harmony with the indications of the individual cows.

A glance at fig. 56, p. 331, in which the weekly means for the two groups are contrasted, reveals further that precisely similar fluctuations took place during the period in the fat-content as were noted in the case of the yield, a sharply defined improvement in the first few days of the period being succeeded by an equally marked deterioration in the second week, whilst in the latter half of the period there were indications of a return to the original conditions.

The changes were, however, in every case slight, the greatest difference in the fluctuations of the weekly means being the virtual rise of 0·1 per cent in the first week.

*Percentage of Solids-not-Fat.*

From the data in Table IV. (*c*), p. 306, it will be seen that the changes recorded in the means for the period are very slight in the case of each group, and, moreover, that little further light as to the effects, if any, of the changes of treatment investigated can be obtained by a comparison of the records of the individual cows.

On the whole there are, perhaps, some signs of a slight improvement in the case of the Test Group; but in view of the smallness of the changes in question, and the uncertainty attaching to the indirect method by which the proportion of

solids-not-fat in the samples was arrived at (cf. 'Transactions,' 1904, p. 271), the writer would give this opinion with all reserve.

If the weekly means may be trusted, then, as may be seen in fig. 56, p. 331, the changes produced were of a similarly fluctuating nature to those recorded in the case of the yield and the percentage of fat—a preliminary improvement being rapidly succeeded by a temporary deterioration, and subsequent return to the normal level, as indicated by the Control Group.

## EVENING MILK.

The data referred to in the discussion of the fluctuations in the amount and composition of the milk yielded at the evening milking during the second period are contained in Table V., p. 310.

It must be borne in mind that the yields of milk are in each case considerably lower than at the morning milking, and hence the possibilities of error are correspondingly greater. Especially will this be the case in connection with the data concerning the fat-content of the milk.

### *Yield.*

From the data in Table V. (*a*), p. 310, it will be noted that the average falling off in the yield at the evening milking during Period II. was for both groups practically the same, and, moreover, that there was a close resemblance in the magnitude of the decreases recorded by the individual members of each group.

Taking the period as a whole, therefore, the changes investigated had no effect on the yield of milk at the evening milking. Nor can any appreciable effect at any part of the period be detected when the weekly means for the two groups are compared (fig. 57, p. 332), unless the somewhat greater decrease recorded in the third week of the period be attributable to the changes of treatment introduced at the beginning of the period (cf. also Yield A.M., fig. 56).

### *Percentage of Fat.*

From the data in Table V. (*b*), p. 310, it will be seen that although the mean percentage of fat in the case of the Test Group increased slightly more than the mean for the Control Group in the period under discussion, this is attributable entirely to the depressing effect on the latter mean of the unusually large *decrease* in the case of Cow No. 2. Indeed, but for the inclusion of this cow in the group, the Control Group would have shown slightly the better results.

## TABLE V.—Comparison of Periods I. and II.

### Evening Milk.

### (a) YIELD.

| Control Group | | | | Test Group. | | | |
|---|---|---|---|---|---|---|---|
| Cow No. | Mean for Period I. | Mean for Period II | Difference. | Cow No. | Mean for Period I | Mean for Period II. | Difference |
| | lb | lb. | Per cent | | lb. | lb | Per cent. |
| 8 | 14·8 | 11·7 | −20·9 | 19 | 17·6 | 14·2 | −19·3 |
| 17 | 14·1 | 11·6 | −17·7 | 16 | 14·2 | 11·5 | −19·0 |
| 14 | 19·3 | 16·0 | −17·1 | 7 | 17·6 | 14·4 | −18·2 |
| 5 | 11·4 | 9·5 | −16·6 | 15 | 15·2 | 12·6 | −17·1 |
| 2 | 18·3 | 15·3 | −16·4 | 12 | 14·8 | 12·4 | −16·2 |
| 9 | 14·8 | 12·4 | −16·2 | 23 | 18·5 | 15·8 | −14·5 |
| 6 | 11·3 | 10·8 | − 4·4 | 10 | 9·9 | 9·5 | − 4·0 |
| Mean for group | 104·0 | 87·3 | −16·1 | ... | 107·8 | 90·4 | −16·2 |

### (b) PERCENTAGE OF FAT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | | Per cent | Per cent | Per cent |
| 2 | 4·50 | 4·15 | −0·35 | 12 | 3·85 | 3·80 | −0·05 |
| 8 | 3·89 | 3·91 | +0·02 | 15 | 3·62 | 3·70 | +0·08 |
| 17 | 3·41 | 3·55 | +0·14 | 19 | 4·05 | 4·14 | +0·09 |
| 6 | 4·48 | 4·66 | +0·18 | 10 | 3·85 | 3·99 | +0·14 |
| 14 | 4·13 | 4·31 | +0·18 | 7 | 4·10 | 4·25 | +0·15 |
| 5 | 4·15 | 4·34 | +0·19 | 23 | 4·33 | 4·50 | +0·17 |
| 9 | 3·80 | 3·99 | +0·19 | 16 | 4·45 | 4·70 | +0·25 |
| Mean for group | 4·05 | 4·13 | +0·08 | ... | 4·04 | 4·16 | +0·12 |

### (c) PERCENTAGE OF SOLIDS-NOT-FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent. | Per cent | | Per cent | Per cent. | Per cent. |
| 17 | 9·06 | 8·72 | −0·34 | 12 | 8·77 | 8·51 | −0·26 |
| 2 | 8·93 | 8·69 | −0·24 | 19 | 9·10 | 8·86 | −0·24 |
| 9 | 8·82 | 8·67 | −0·15 | 23 | 8·92 | 8·75 | −0·17 |
| 6 | 9·05 | 8·94 | −0·11 | 16 | 9·43 | 9·26 | −0·17 |
| 14 | 8·83 | 8·74 | −0·09 | 7 | 9·01 | 8·92 | −0·09 |
| 5 | 8·93 | 8·86 | −0·07 | 15 | 8·83 | 8·76 | −0·07 |
| 8 | 8·95 | 8·91 | −0·04 | 10 | 8·89 | 8·85 | −0·04 |
| Mean for group | 8·94 | 8·79 | −0·15 | ... | 8·99 | 8·85 | −0·14 |

Although the effects on the means for the whole period were thus so small as to be practically negligible, this was by no means the case at different intervals during the period—as may be seen in fig. 57, p. 332. The fluctuations there indicated are precisely similar to those recorded in the case of the morning milk (p. 308 ; cf. also fig. 56, p. 331)—the improvement, as compared with the Control Group, indicated by the means for the first week being followed by a marked deterioration in the second week, after which probably the differences between the two groups gradually disappeared, the divergence in the third week being attributable mainly, if not entirely, to the exceptional records of Cow No. 8.[1]

### *Percentage of Solids-not-Fat.*

From the data given in Table V. (*c*), p. 310, it will be seen that the changes in the mean percentages of solids-not-fat in the milk of the two groups were greater than those recorded in the case of the morning milk. Here again, however, the decrease in the group means was practically identical in both cases, and, moreover, the comparison of the individual records in the two groups leads to the same conclusion.

Nor is any striking difference to be detected between the changes recorded week by week by the two groups (*vide* fig. 57, p. 332), the record for the first two weeks being indeed almost exactly parallel.

It may safely be concluded, therefore, that the percentage of solids-not-fat in the evening milk was not appreciably affected by the changes of treatment under investigation.

### SUMMARY OF CONCLUSIONS as to Effects of Changes investigated in Period II.

It would appear from the foregoing discussion of the experimental data obtained during Period II. that the immediate effect of the substitution of the highly nitrogenous ration, given in the morning only, for the ration poor in nitrogen and given morning and evening, was to cause a slight virtual improvement all round both at the morning and at the evening milkings. This improvement was, however, only very temporary, being followed indeed by a reaction in the opposite direction, whilst towards the end of the period there were indications that

[1] The relative deterioration in the second week would not have been so great but for the unusually high increase recorded in this week by Cow No. 8 of the Control Group (cf. Table XV., p. 337). This explains also the marked fall in the mean for the Control Group for the following week.

the effects of the changes had already disappeared or were rapidly disappearing.

These generalisations apply more especially to the milk-yield and percentage of fat—the changes in the case of the percentage of solids-not-fat being less sharply defined.

The changes of treatment had practically no effect on the ratio of the morning yield and percentage of fat to the corresponding values at the evening milking, as may be seen by comparing the mean ratios for Periods I. and II. given in Tables II. and III., pp. 302, 303.

The changes in live-weight of the cows during Period II. were:—

| Control Group. | | Test Group. | |
|---|---|---|---|
| Cow No. | Gain (+) or Loss (−) lb. | Cow No. | Gain (+) or Loss (−) lb. |
| 2 | + 2 | 7 | −24 |
| 5 | +26 | 10 | + 2 |
| 6 | +32 | 12 | −18 |
| 8 | + 8 | 15 | − 2 |
| 9 | −20 | 16 | − 8 |
| 14 | + 4 | 19 | − 4 |
| 17 | −10 | 23 | −16 |
| Total gain or loss | +42 | Total gain or loss | −70 |
| Average per cow | + 6 | Average per cow | −10 |

It will be noted that whilst the changes on the whole were very slight, there was a slight falling off in weight in the case of the Test Group cows, whereas the Control Group cows gained slightly in weight on the average. The Test Group cows were thus apparently at a slight disadvantage in some respect, and this may perhaps account partly for the extreme smallness of the changes recorded (compare, however, p. 324). Wherein the disadvantage lay it is difficult to say, but it may perhaps have been in some way connected with the trying nature of the season, since no such disadvantage was observed when practically the same rations were compared in 1903 (*vide* 'Transactions,' 1904, pp. 274-276).

### PERIOD III.—Decorticated Cotton-cake *v.* Maize.

The only change made at the end of Period II. (on August 2) consisted in the substitution of 3 lb. maize-meal in the daily ration of each cow of the Test Group for the 3 lb. decorticated cotton-cake of the daily ration supplied to these cows throughout Period II.—the stall food of this group being thus still given in the morning only.

A comparison of the results of Periods II. and III should,

## TABLE VI.—Comparison of Periods II and III.

### Morning Milk.

### (a) YIELD.

| Control Group. | | | | Test Group | | | |
|---|---|---|---|---|---|---|---|
| Cow No. | Mean for Period II | Mean for Period III. | Difference. | Cow No. | Mean for Period II | Mean for Period III | Difference. |
| | lb. | lb | Per cent. | | lb. | lb | Per cent. |
| 17 | 17·9 | 15·3 | −14·5 | 12 | 16·1 | 13·8 | −14·3 |
| 5 | 13·3 | 11·8 | −11·3 | 15 | 17·8 | 15 6 | −12·4 |
| 2 | 23·8 | 21·2 | −10·9 | 23 | 22·5 | 20·1 | −10·7 |
| 6 | 14·1 | 12 8 | − 9·2 | 19 | 19·3 | 17·6 | − 8·8 |
| 9 | 18·3 | 16·7 | − 8·7 | 16 | 16·2 | 15·0 | − 7·4 |
| 8 | 17·7 | 16·7 | − 5·7 | 7 | 18·4 | 17·4 | − 5·4 |
| 14 | 21·2 | 20·3 | − 4·2 | 10 | 14·1 | 13·4 | − 5·0 |
| Mean for group | 126·3 | 114·8 | − 9·1 | ... | 124·4 | 112 9 | − 9·2 |

### (b) PERCENTAGE OF FAT.

| Cow No. | Period II | Period III | Difference | Cow No. | Period II | Period III | Difference |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent. | | Per cent. | Per cent | Per cent. |
| 5 | 3·20 | 3 25 | +0·05 | 7 | 2·7[illegible] | 2·77 | −0·02 |
| 6 | 3·66 | 3·72 | +0·06 | 19 | 2·95 | 2·99 | +0·04 |
| 2 | 2 72 | 2·87 | +0·15 | 12 | 2·51 | 2·55 | +0·04 |
| 14 | 2·62 | 2·79 | +0·17 | 10 | 3·41 | 3·55 | +0·14 |
| 8 | 2·71 | 2·91 | +0·20 | 15 | 2 45 | 2·65 | +0·20 |
| 9 | 2 69 | 3·00 | +0·31 | 16 | 3·05 | 3·32 | +0·27 |
| 17 | 2·21 | 2 53 | +0·32 | 23 | 2 67 | 3·03 | +0·36 |
| Mean for group | 2·83 | 3·01 | +0·18 | ... | 2·83 | 2 98 | +0·15 |

### (c) PERCENTAGE OF SOLIDS-NOT-FAT.

| Cow No. | Period II | Period III | Difference | Cow No. | Period II | Period III | Difference |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | | Per cent. | Per cent | Per cent. |
| 9 | 8·88 | 8·69 | −0·19 | 12 | 8·77 | 8 25 | −0·52 |
| 8 | 9·03 | 8·87 | −0·16 | 10 | 9·09 | 8 81 | −0·28 |
| 14 | 8·91 | 8·77 | −0·14 | 7 | 8·99 | 8·78 | −0·21 |
| 5 | 8·97 | 8·86 | −0·11 | 16 | 9·35 | 9·21 | −0·14 |
| 2 | 8·83 | 8·73 | −0·10 | 19 | 9·00 | 8·88 | −0·12 |
| 6 | 9·12 | 9·07 | −0·05 | 15 | 8·95 | 8·84 | −0·11 |
| 17 | 8·88 | 8·92 | +0·04 | 23 | 8·88 | 8·85 | −0·03 |
| Mean for group | 8·95 | 8·84 | −0·13 | ... | 9·00 | 8·80 | −0·20 |

therefore, furnish information as to the effects of this change from a highly nitrogenous food to a food poor in nitrogenous constituents,[1] or, more strictly, from decorticated cotton-cake to maize.

The data requisite for this comparison are contained in Tables VI. and VII., pp. 313 and 316.

## MORNING MILK.

### *Yield.*

From the data contained in Table VI. (*a*), p. 313, it will be observed that the average decrease of the morning yield for Period III. was practically the same for both groups, and, moreover, that these means are a fair index of the changes in the case of the individual cows. Taking the period as a whole the effect of the change of food on the yield was thus practically nil.

On comparing the "weekly"[2] means (fig. 56, p. 331), however, it will be seen that the mean yield for the Test Group was more nearly equal to the mean yield for the Control Group during the first half of Period III. than during any other period of the experiment subsequent to the week ending July 11, from which it would appear that the change to maize tended at first to *check* the falling off in yield somewhat—*i.e.*, to produce a virtual *increase* of yield as compared with the Control Group. The effect, however, was very temporary, and there were indications during the last week of the period of a falling off of the yield as compared with the Control Group.

At the most the changes effected were but slight, the virtual improvement in the first week amounting per day to but 1·6 per 100 lb. total yield. It is doubtful whether the methods of experiment are precise to the degree necessary for the detection of such slight effects.

### *Percentage of Fat.*

From the data in Table VI. (*b*), p. 313, it will be observed that the rise in the percentage of fat was slightly more pronounced in the case of the Control Group, and the inference as to the *depressing* effect of maize on the fat-content is strengthened somewhat by the comparison of the records of the individual cows.

On comparing the "weekly" means (fig. 56, p. 331), however, it will be noted that the depression was very pronounced only in the first few days of the period—a depression of 0·14 per cent,

[1] Cf. 'Trans.,' 1902, vol. xiv. p. 295; 1904, vol. xvi. p. 276.

[2] The period is subdivided into three intervals of 5, 7, and 7 days respectively (*vide* p. 301).

as compared with the Control Group, being indicated by the means for the first five days—but that in the rest of the period no such depression is recorded, the original conditions being apparently rapidly restored.

*Percentage of Solids-not-Fat.*

From the data given in Table VI. (*c*), p. 313, it will be observed that the falling off in the percentage of solids-not-fat was rather more pronounced in the case of the mean for the Test Group than in the case of the Control Group; and, moreover, this is fully borne out by the comparison of the records of the individual cows, although the magnitude of the depression is exaggerated by the exceptionally large depression in the case of Cow No. 12,[1] and still further slightly by the fact that No. 17 (Control Group) alone of the fourteen cows recorded an actual *increase* in the period under discussion.

On referring to the diagram (fig. 56, p. 331), in which the "weekly" means are contrasted, it will be noted that the depression of the mean for the Test Group relative to that of the Control Group was marked in the first few days after the change of food—the mean for the Test Group falling for the first time below that of the Control Group—and was even more marked in the second week, but that there were signs of a return to normal conditions towards the end of the period.

The change from decorticated cotton-cake to maize thus undoubtedly was followed by a falling off in the percentage of solids-not-fat, amounting on the average during the first ten days or so, if not longer, to 0·05–0·1 per cent.

EVENING MILK.

The data referred to in the discussion of the records for the evening milk during the Third Period are contained in Table VII., p. 316.

*Yield.*

From the data given in Table VII. (*a*), it will be seen that the falling off in the average evening milk-yield was decidedly more pronounced in the case of the Test Group than in the case of the Control Group, and, moreover, that the group means are a fair index of the changes in the case of the individual cows.

From the "weekly" means (fig. 57, p. 332) it will further be

[1] Attention may here be directed to the remarkable falling off of the proportion of solids-not-fat in the milk—morning and evening—of this cow, from about the middle of Period II. onwards. It is greatly to be regretted that it was not possible to make a more detailed analysis of the samples taken from this cow.

TABLE VII.—COMPARISON OF PERIODS II. AND III

EVENING MILK.

(a) YIELD.

| Control Group | | | | Test Group. | | | |
|---|---|---|---|---|---|---|---|
| Cow No | Mean for Period II | Mean for Period III. | Difference. | Cow No. | Mean for Period II. | Mean for Period III. | Difference |
| | lb | lb. | Per cent. | | lb | lb | Per cent. |
| 17 | 11·6 | 9·6 | −17·2 | 23 | 15·8 | 12·3 | −22·2 |
| 2 | 15·3 | 12·8 | −16·3 | 12 | 12·4 | 9·8 | −21·0 |
| 8 | 11·7 | 10·0 | −14·5 | 7 | 14·4 | 11·4 | −20·8 |
| 14 | 16 0 | 14·0 | −12·5 | 15 | 12·6 | 10·6 | −15·9 |
| 9 | 12·4 | 10·9 | −12·1 | 19 | 14·2 | 12·1 | −14·8 |
| 6 | 10·8 | 9·6 | −11·1 | 10 | 9·5 | 8·1 | −14·7 |
| 5 | 9·5 | 8·9 | − 6·3 | 16 | 11 5 | 9·9 | −13·9 |
| Mean for group | 87·3 | 75·8 | −13·2 | ... | 90·4 | 74·2 | −17·9 |

(b) PERCENTAGE OF FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | | Per cent. | Per cent | Per cent. |
| 2 | 4·15 | 4·04 | −0·11 | 23 | 4·50 | 4·12 | −0·38 |
| 14 | 4 31 | 4·26 | −0·05 | 7 | 4·25 | 4·11 | −0·14 |
| 17 | 3 55 | 3 53 | −0·02 | 10 | 3·99 | 3·98 | −0·01 |
| 8 | 3·91 | 3·96 | +0·05 | 19 | 4 14 | 4·19 | +0·05 |
| 5 | 4·34 | 4·57 | +0·23 | 12 | 3·80 | 3·88 | +0·08 |
| 6 | 4 66 | 4 99 | +0·33 | 16 | 4·70 | 4·79 | +0·09 |
| 9 | 3 99 | 4 41 | +0·42 | 15 | 3 70 | 3·84 | +0·14 |
| Mean for group | 4·13 | 4·25 | +0·12 | ... | 4·16 | 4·13 | −0·03 |

(c) PERCENTAGE OF SOLIDS-NOT-FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent. | | Per cent | Per cent | Per cent. |
| 5 | 8·86 | 8·78 | −0·08 | 12 | 8·51 | 8·24 | −0·27 |
| 8 | 8·91 | 8·86 | −0·05 | 7 | 8·92 | 8·78 | −0·14 |
| 2 | 8·69 | 8·69 | 0·00 | 23 | 8·75 | 8·67 | −0·08 |
| 6 | 8·94 | 8·94 | 0·00 | 19 | 8·86 | 8·80 | −0·06 |
| 14 | 8·74 | 8·74 | 0·00 | 10 | 8·85 | 8·83 | −0·02 |
| 9 | 8·67 | 8·73 | +0·06 | 15 | 8·76 | 8·76 | 0·00 |
| 17 | 8 72 | 8·78 | +0·06 | 16 | 9·26 | 9·28 | +0·02 |
| Mean for group | 8·79 | 8·79 | 0·00 | ... | 8·85 | 8·77 | −0·08 |

noted that the decrease as compared with the Control Group was confined to the first half of the period, the means for the last week indicating a return to normal relations.

The change of food was thus followed by a slight falling off, as compared with the Control Group, in the yield of the Test Group cows at the evening milking, the effect being, however, only very temporary and slight.

### *Percentage of Fat.*

The differences between the mean percentages of fat for Periods II. and III. respectively (Table VII. (*b*), p. 316) for the two groups are in sharp contrast, in that whereas a pronounced rise took place in the case of the Control Group, the mean for the Test Group showed an actual decrease, pointing to the conclusion that the change of diet caused an even greater deterioration in the fat-content of the milk of the Test Group as compared with the Control Group.

This conclusion is, on the whole, borne out by a comparison of the data for the individual cows, although it may be noted that the depression of the mean fat-content in the case of the Test Group is exaggerated by the exceptionally large decrease recorded by Cow No. 23.

When the "weekly" means are compared (fig. 57, p. 332), it is apparent that the falling off was confined to the first half of the period, there being signs that the depressing effect had ceased towards the end of the period.

### *Percentage of Solids-not-Fat.*

The mean percentages of solids-not-fat for Periods II. and III., and the differences between them, are recorded in Table VII. (*c*), p. 316.

It will be noted that the changes recorded are very slight, except in the case of cows 7 and 12 (Test Group), and hence that there is very little difference in the group means for the two periods.

Nor do the "weekly" means furnish any indications that the change of diet had any pronounced effect on the proportion of non-fatty solids in the evening milk (fig. 57, p. 332), unless, indeed, the fact be of significance in this connection that from the commencement of this period onwards the mean percentage for the Test Group was almost invariably lower than that for the Control Group, whereas previously it had been invariably higher.

In view of the uncertainty attaching to the data concerning solids-not-fat, it is not advisable, however, to go beyond the practical conclusion—viz., that the change of diet did not at any time during the period[1] considerably affect the proportion of solids-not-fat in the evening milk.

### SUMMARY OF CONCLUSIONS as to Effects of Change investigated in Period III.

It would appear from the foregoing discussion of the experimental data obtained during Period III. that the replacement of the highly nitrogenous food (decorticated cotton-cake) by food poor in nitrogen (maize) had but little effect on the *milk-yield* under the conditions of the experiment, producing, if anything, a slight temporary improvement of the morning yield —as noted in previous years,[2]—but not of the evening yield. Indeed, after the first week the evening yield showed signs of falling off.

The *percentage of fat* suffered for a time a virtual decrease in the case of both the morning and evening milk, whilst there were indications of a similar deterioration in the *percentage of solids-not-fat.*

The changes produced were, however, in all cases very slight and apparently of a more or less temporary nature. With this limitation the observations are in agreement with those of previous years.[2]

### PERIOD IV.—Morning Feeding *v.* Morning and Evening Feeding.

On referring to the schematic outline of the experiment on p. 299, it will be noted that the only difference in the treatment of the two groups during Period III. was that whereas the cows of the Control Group received half their dry food in the morning and the other half at night, the cows of the Test Group received the whole ration for the day at the morning milking. At the end of this period the groups were treated alike in this respect also, the Test Group cows receiving their dry food in two halves daily for the remaining twenty days (Period IV.) during which samples were taken.

A comparison of the records for Periods III. and IV. may

[1] The apparent deterioration in the second week is largely explained by the exceptional *increase* recorded in this week by Cow No. 9 (Control Group) (cf. Table XVI., p. 338)

[2] Trans., 1902, p. 295; 1904, p. 276.

hence be expected to furnish evidence as to the relative merits of the two modes of feeding.[1]

## MORNING MILK.

The data requisite for this comparison are contained in Table VIII., p. 320. It should be noted that the period is subdivided into three intervals of 5, 7, and 8 days respectively, and the means for these intervals are referred to in the discussion as the "weekly" means.

### *Yield.*

From the mean decreases for the groups (Table VIII. (*a*), p. 320), it will be seen that the morning yield of the Test Group fell off proportionately rather more than that of the Control Group, but on further analysis of the table it will be found that the difference is largely accounted for by the exceptionally high falling off in yield in the case of Cow No. 7.

Moreover on referring to the "weekly" means, as recorded graphically in fig. 56, p. 331, it will be noted that already before the close of Period III. there were indications of a tendency for the mean yield of the Test Group to diminish at a rather more rapid rate than that of the Control Group, so that the difference cannot be attributed entirely—if indeed even in part—to the change in the mode of feeding. If the latter had any effect at all on the yield then, from the diagram it would appear to have slightly *accentuated* the falling off as compared with the decrease in the yield of the Control Group.

### *Percentage of Fat.*

From the data given in Table VIII. (*b*), p. 320, it will be noted that in the case of the majority of the cows of both groups very striking increases of the percentage of fat were recorded during Period IV., and further, that on the whole the improvement was distinctly greater in the milk of the Control Group than in that of the Test Group. The difference between the mean increases for the groups amounting to 0·06 per cent.

The change in the mode of feeding was thus apparently rather detrimental in this respect. When the "weekly" means are

[1] Further reference (cf. p 298) must here be made to the fact that during this period four cows—viz., Nos. 5 and 14 of the Control Group and Nos. 10 and 23 of the Test Group—for the purposes of another experiment, were housed through the night, receiving hay *ad lib.* to compensate for the removal from pasture. Since the two pairs are fairly "equal" in most respects, it is believed that this variation from the treatment of the remaining cows will not appreciably affect the general conclusions as to the mode of feeding.

## TABLE VIII.—Comparison of Periods III and IV.

### Morning Milk.

#### (a) YIELD.

| Control Group | | | | Test Group | | | |
|---|---|---|---|---|---|---|---|
| Cow No | Mean for Period III | Mean for Period IV | Difference. | Cow No | Mean for Period III. | Mean for Period IV. | Difference. |
| | lb | lb | Per cent | | lb. | lb. | Per cent. |
| 5 | 11·8 | 9 5 | −19·5 | 7 | 17·4 | 12·4 | −28·7 |
| 17 | 15·3 | 13·0 | −15·0 | 23 | 20·1 | 16·2 | −19·4 |
| 8 | 16 7 | 14·2 | −15·0 | 12 | 13·8 | 11 5 | −16·7 |
| 9 | 16 7 | 14 3 | −14·4 | 10 | 13·4 | 11·2 | −16·4 |
| 6 | 12 8 | 11 0 | −14·1 | 16 | 15·0 | 12·9 | −14·0 |
| 14 | 20 3 | 17·5 | −13·7 | 15 | 15 6 | 13·7 | −12·2 |
| 2 | 21 2 | 18 8 | −11·3 | 19 | 17·6 | 15·6 | −11·4 |
| Mean for group | 114 8 | 98 3 | −14·4 | ... | 112·9 | 93 5 | −17·2 |

#### (b) PERCENTAGE OF FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | | Per cent | Per cent | Per cent. |
| 8 | 2 91 | 3·00 | +0·09 | 7 | 2 77 | 2 80 | +0·03 |
| 17 | 2 53 | 2 66 | +0·11 | 10 | 3 55 | 3 59 | +0·04 |
| 6 | 3·72 | 4·03 | +0·31 | 12 | 2 55 | 2 66 | +0·11 |
| 14 | 2 79 | 3 12 | +0·33 | 19 | 2 99 | 3·23 | +0·24 |
| 9 | 3·00 | 3 35 | +0·35 | 15 | 2·65 | 2·94 | +0·29 |
| 2 | 2·87 | 3 23 | +0·36 | 16 | 3 32 | 3·77 | +0·45 |
| 5 | 3·25 | 3·80 | +0·55 | 23 | 3·03 | 3·60 | +0·57 |
| Mean for group | 3·01 | 3 31 | +0·31 | ... | 2·98 | 3·23 | +0·25 |

#### (c) PERCENTAGE OF SOLIDS NOT-FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent | Per cent | Per cent | | Per cent | Per cent | Per cent. |
| 8 | 8·87 | 8·66 | 0·21 | 12 | 8 25 | 7·90 | −0·35 |
| 2 | 8·73 | 8 55 | −0·18 | 15 | 8 84 | 8·68 | −0·18 |
| 6 | 9 07 | 8·97 | −0·10 | 23 | 8·85 | 8·73 | −0·12 |
| 5 | 8·86 | 8·78 | −0·08 | 7 | 8 78 | 8 68 | −0·10 |
| 9 | 8·69 | 8 62 | −0·07 | 19 | 8·88 | 8·80 | −0·08 |
| 17 | 8·92 | 9 04 | +0·12 | 10 | 8·81 | 8·80 | −0·01 |
| 14 | 8·77 | 8·94 | +0·17 | 16 | 9·21 | 9·27 | +0·06 |
| Mean for group | 8·84 | 8·80 | −0·04 | .. | 8·80 | 8·70 | −0·10 |

compared (fig. 56, p. 331), it will be observed that the deterioration was most pronounced in the first "week," but was apparent to a lesser extent throughout the rest of the period.

*Percentage of Solids-not-Fat.*

From the data given in Table VIII. (*c*), p. 320, referring to the percentage of solids-not-fat, it will be noted that the group means for Period IV. show a falling off in both cases, the greater decrease being recorded by the Test Group, so that a slight falling off in the proportion of solids-not-fat is indicated as the result of the change in the mode of feeding.

This conclusion is strengthened by the comparison of the records of the individnal cows in the two groups, and on referring to the diagram, fig. 56, p. 331, it will be noted that the falling off was marked in the earliest stages and practically maintained throughout the period.

EVENING MILK.

The data referred to in the discussion will be found in Table IX., p. 322.

*Yield.*

From the data in Table IX. (*a*), p. 322, it will be observed that the mean evening yield of the Test Group did not fall off quite so markedly as the mean yield of the Control Group, and, moreover, this conclusion is borne out by a comparison of the differences for the individual cows in each group.

The fact must not be overlooked, however, that by this time the yield of milk at the evening milking had in most cases become very small, and hence the possibilities of error would be considerably increased.

From the diagram, fig. 57, p. 332, it will further be observed that the improvement relative to the yield of the Control Group was confined to the first half of the period, and, moreover, that it was but the continuation of a tendency in this direction noticeable in the latter half of the previous period. If the differences may be attributed to the change in the mode of feeding, they must be regarded as indicating a relative improvement of the evening yield for a short period after the change.

*Percentage of Fat.*

From the data in Table IX. (*b*), p. 322, it will be seen that a decidedly greater increase in the percentage of fat in the evening milk was recorded in the case of the Test Group than

## TABLE IX.—Comparison of Periods III. and IV.

### Evening Milk.

### (a) YIELD.

| Control Group | | | | Test Group. | | | |
|---|---|---|---|---|---|---|---|
| Cow No | Mean for Period III | Mean for Period IV. | Difference | Cow No | Mean for Period III | Mean for Period IV. | Difference. |
| | lb | lb | Per cent | | lb | lb | Per cent. |
| 14 | 14·0 | 13·2 | − 5·7 | 10 | 8·1 | 7·6 | − 6·2 |
| 8 | 10·0 | 8·7 | −13·0 | 16 | 9·9 | 9·2 | − 7·1 |
| 6 | 9·6 | 8·2 | −14·6 | 7 | 11·4 | 10·1 | −11·4 |
| 2 | 12·8 | 10·9 | −14·8 | 19 | 12·1 | 10·5 | −13·2 |
| 17 | 9·6 | 7·8 | −18·8 | 23 | 12·3 | 10·2 | −17·1 |
| 9 | 10·9 | 8·4 | −22·9 | 15 | 10·6 | 8·7 | −17·9 |
| 5 | 8·9 | 6·1 | −31·5 | 12 | 9·8 | 7·5 | −23·5 |
| Mean for group | 75·8 | 63·3 | 16·5 | .. | 74·2 | 63·8 | −14·0 |

### (b) PERCENTAGE OF FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent. | Per cent | Per cent | | Per cent | Per cent | Per cent. |
| 8 | 3·96 | 3·88 | +0·02 | 12 | 3·88 | 3·84 | −0·04 |
| 2 | 4·04 | 4·09 | +0·05 | 7 | 4·11 | 4·08 | −0·03 |
| 6 | 4·99 | 5·07 | +0·08 | 19 | 4·19 | 4·36 | +0·17 |
| 5 | 4·57 | 4·73 | +0·16 | 15 | 3·84 | 4·07 | +0·23 |
| 14 | 4·26 | 4·46 | +0·20 | 23 | 4·12 | 4·43 | +0·31 |
| 9 | 4·41 | 4·62 | +0·21 | 10 | 3·98 | 4·38 | +0·40 |
| 17 | 3·53 | 3·85 | +0·32 | 16 | 4·79 | 5·28 | +0·49 |
| Mean for group | 4·25 | 4·39 | +0·14 | ... | 4·13 | 4·35 | +0·22 |

### (c) PERCENTAGE OF SOLIDS-NOT-FAT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Per cent. | Per cent | Per cent | | Per cent | Per cent | Per cent |
| 5 | 8·78 | 8·42 | −0·36 | 12 | 8·24 | 7·66 | −0·58 |
| 14 | 8·74 | 8·48 | −0·26 | 10 | 8·83 | 8·54 | −0·29 |
| 8 | 8·86 | 8·63 | −0·23 | 15 | 8·76 | 8·52 | −0·24 |
| 6 | 8·94 | 8·74 | −0·20 | 23 | 8·67 | 8·50 | −0·17 |
| 2 | 8·69 | 8·54 | −0·15 | 7 | 8·78 | 8·66 | −0·12 |
| 9 | 8·73 | 8·64 | 0·09 | 19 | 8·80 | 8·75 | −0·05 |
| 17 | 8·78 | 8·87 | +0·09 | 16 | 9·28 | 9·27 | 0·01 |
| Mean for group | 8·79 | 8·62 | −0·17 | ... | 8·77 | 8·56 | −0·21 |

in the case of the Control Group; and apart from Nos. 7 and 12, which recorded an actual decrease, this is well borne out by comparison of the individual changes in both groups.

From the diagram, fig. 57, p. 332, it will further be noted that the greater increase was confined to the first half of the period, the mean fat-content of the milk of the Test Group during the last 8 days showing indeed an actual falling off, whereas a decided rise was recorded in the case of the Control Group.[1]

There was thus a slight improvement in the percentage of fat in the evening milk of the Test Group—as compared with the Control Group—during the first half of Period IV.[2]

### *Percentage of Solids-not-Fat.*

The data in Table IX. (*c*), p. 322, are inconclusive as to the effect of the change in the mode of feeding on the percentage of solids-not-fat in the evening milk. For although the group means indicate a slightly greater falling off in the case of the Test Group than in the case of the Control Group, the comparison of the records of the individual cows rather indicates that this difference was purely accidental, and determined entirely by the remarkable falling off in the case of Cow No. 12, to which allusion has been made previously (p. 315). To this cow, moreover, is mainly attributable the remarkable falling off in the mean for the Test Group during the latter half of the period, which is evident in the diagram (fig. 57, p. 332).

### SUMMARY OF CONCLUSIONS as the Effects of Change investigated in Period IV.

It would appear from the foregoing discussion of the experimental data obtained during Period IV. that the change from the system of giving all the stall food at the morning milking to the giving of it in two halves at the morning and evening milkings respectively, was followed by a slight *falling off* in the morning milk-yield and its content of fat and solids-not-fat, whereas the changes in connection with the evening milk were rather in the opposite direction—the percentage of solids-not-fat alone forming a doubtful exception. These conclusions are, in the main, in harmony with those arrived at in previous years ('Transactions,' 1903, 1904), and particularly with respect to the effect on the fat-content of the morning milk.

[1] The fluctuations in the case of the individual cows differed considerably, however, during this week. (Cf. Tables XI.-XXIV., pp. 333-346.)

[2] Attention may be here directed to the considerable increases in the fat-content recorded in the case of many cows during this period—*e.g.*, Nos. 10, 16, 17, 23. (Cf. also morning milk, p. 320.)

The changes in live-weight of the cows during Periods III. and IV. (*i.e.*, after the return to the ration of Period I.) were as follows:—

| Control Group. Cow No. | Gain (+) or Loss (−) lb | Test Group. Cow No | Gain (+) or Loss (−) lb. |
|---|---|---|---|
| 2 | −44 | 7 | −22 |
| 5 | +56 | 10 | +14 |
| 6 | + 2 | 12 | + 6 |
| 8 | +20 | 15 | +20 |
| 9 | +10 | 16 | −28 |
| 14 | −12 | 19 | + 4 |
| 17 | +30 | 23 | −24 |
| Total gain or loss | +62 | Total gain or loss | −20 |
| Average per cow | + 9 | Average per cow | − 3 |

As during Period II., so also during the latter half of the experiment, the changes in weight were, on the average, only slight, although the falling off previously noted in the case of the Test Group cows was in several cases continued throughout the experiment.

## General Review of the Whole Experiment.

Throughout the foregoing discussion of the data obtained in the experiment, it has been repeatedly noted that the changes under discussion were very slight, and, moreover, that the individuality of the animals is a factor of such importance that the variations thereby introduced rendered the mean values for the groups in many cases unsafe as indicating the nature of the changes that took place during the period to which they referred.

In this connection it should be borne in mind that the conditions under which these experiments were carried out were in some respects[1] such as to give rise to the greatest possible fluctuations from morning to evening and from day to day in the yield and quality of the milk, and hence a correspondingly greater uncertainty in the deduction of the effects of the changes investigated.

No pretensions are made, therefore, to regard the experiments as being more than a *qualitative* test of the effects of the changes, although they are apparently sufficiently precise to furnish at least an *approximate* estimate of the magnitude of the effects involved.

Bearing these limitations in mind, the following conclusions

[1] For example, in respect of the great inequality of the intervals between milkings, the variability of the climatic conditions and their effect on the pastures, &c.

may safely be drawn as to the effects of the changes investigated in the present experiment:—

1. A substitution of decorticated cotton-cake for maize-meal given to cows while at pasture day and night has very little effect on either the quantity of milk produced or on its content of fat and solids-not-fat.
2. Other conditions being equal, the morning milk is probably as a rule of slightly better quality when the stall food is given all at the morning milking than when only half is given in the morning and the rest at the evening milking.
3. The individuality of each cow and its condition during the period of the experiment are important factors in determining the magnitude, and, to a lesser extent, the "direction," of the effects produced.
4. Bearing in mind the limitations imposed by conclusions (1) and (3), cows receiving decorticated cotton-cake to supplement pasturage may be expected to give milk of better quality than cows receiving the same weight of maize-meal.
5. The effects of *changes* in the nature of the food and the mode of feeding are most pronounced immediately after the change, but rapidly diminish in intensity.[1]

It must be borne in mind that, strictly speaking, these conclusions are valid only for the experiment under discussion; but in view of the fact that precisely similar conclusions have been arrived at in the investigations of the three preceding summers ('Transactions,' 1902, 1903, 1904), it must be considered highly probable that they are of widely general application, and probably independent of the nature of the foods investigated.

In brief, it may be regarded as definitely established that, *under conditions such as prevail at Garforth during the summer*, it is impossible to effect any marked improvement in the quality of the morning milk by any such simple changes as have been investigated in these experiments in the nature of the "concentrated" food supplied, or in the times of feeding.

## "Normal" Changes in the Milk-Secretion during the Experiment.

The "normal" changes in the quantity and quality of the milk secreted during the experiment, as indicated by the fluctuations recorded in the case of the Control Group, afford several points of interest.

[1] This is at variance with the conclusion arrived at in 1903 (Trans., 1904, p. 278). The present experiments are, however, considered more reliable, and certainly the results have been more minutely analysed.

It is commonly accepted that in the absence of disturbing influences, after the lapse of a few weeks immediately subsequent to calving, the milk-yield falls and the fat-content rises with considerable regularity as lactation progresses, whilst the proportion of solids-not-fat remains fairly constant.

That the general tendency of the changes during the experiment here dealt with was in accordance with this generalisation is obvious from the diagrams, figs. 56 and 57, pp. 331, 332, the only notable exception being in the marked falling off in the proportion of solids-not-fat from about the middle of July onwards, which was probably mainly attributable to the dry nature of the season, since a similar falling off during this period was reported in other parts of the country (*vide* Mr F. J. Lloyd's letter to 'The Times' of July 25, 1904).

When the changes from week to week are compared, however, it will be seen that in several instances there were marked deviations from the regular course of the changes,—these deviations being apparent in the case of *both* groups, and hence presumably attributable to some common cause.

Thus, the mean milk-yield at the morning milking during the period August 7 to 13 was in the case of both groups actually higher than that for the immediately preceding period, this being the only occasion throughout the whole experiment when such was the case.

Still more striking deviations are apparent in the case of the mean percentages of fat. Thus, instead of the expected steady increase, a falling off was recorded by both groups in the morning milk in the periods June 14 to 20, July 5 to 11, and notably August 14 to 20, and in the evening milk in the periods June 28 to July 4, and August 2 to 6.

Similar deviations, common to both groups, may also be noted in the case of the solids-not-fat—*e.g.*, in the morning milk in the periods July 19 to 25, August 2 to 6, August 21 to 25, and in the evening milk, notably in the period August 14 to 20.

Since these deviations are common to both groups, and hence independent of the differential treatment to which they were subjected, they can scarcely be regarded as being purely fortuitous, but must be ascribed to some common cause. As to the nature of this common cause, it is as yet impossible to speak with any degree of certainty; but in view of the fact that the weather conditions constituted the most variable influence to which the cows were exposed, and that in previous experiments signs have not been lacking of irregular changes in the milk-secretion coincident with marked alteration of the weather conditions ('Transactions,' 1904, p. 298), it would appear *à priori* not improbable that the explanation of the above-mentioned deviations may be found in the variations of weather during the experi-

ment. In order to test this hypothesis, the fluctuations from day to day in the yield and quality of the milk secreted by the individual cows are being carefully compared with the records of the Garforth Meteorological Station, and it is hoped that the results of this comparison may form the basis of a subsequent communication.

## The Mixed Milk of the Herd

As in previous years, in addition to the samples drawn from the milk of the individual cows, a sample was taken at each milking of the mixed milk of the whole herd, which comprised, on the average, about 20 cows.

The mean results during each week for the percentages of fat and solids-not-fat in the morning and evening milk are given in Table X., together with the highest and lowest value found during the week.

TABLE X.—Mixed Milk of the Herd.

| Week ending | Morning. | | | | | | Evening. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fat | | | Solids not-fat | | | Fat | | | Solids not fat | | |
| | Mean | Min | Max | Mean | Min. | Max | Mean | Min | Max | Mean | Min | Max |
| | % | % | % | % | % | % | % | % | % | % | % | % |
| June 13 | **2·92** | 2·67 | 3·07 | **8·96** | 8·81 | 9·03 | **4·06** | 3·70 | 4·43 | **9·06** | 8·70 | 9·31 |
| " 20 | **2·74** | 2·42 | 3·00 | **8·97** | 8·75 | 9·13 | **3·92** | 3·70 | 4·15 | **9·04** | 8·87 | 9·18 |
| " 27 | **2·89** | 2·54 | 3·28 | **9·03** | 8·90 | 9·27 | **4·04** | 3·47 | 4·5[illegible] | **8·99** | 8·88 | 9·10 |
| July 4 | **2·96** | 2·77 | 3·11 | **9·09** | 8·94 | 9·36 | **4·13** | 3·95 | 4·5[illegible] | **9·05** | 8·92 | 9·22 |
| " 11 | **2·82** | 2·60 | 2·97 | **9·11** | 8·89 | 9·26 | **4·17** | 3·95 | 4·48 | **8·94** | 8·63 | 9·11 |
| " 18 | **2·87** | 2·74 | 2·95 | **9·06** | 8·79 | 9·27 | **4·27** | 4·00 | 4·60 | **8·84** | 8·54 | 9·28 |
| " 25 | **2·96** | 2·70 | 3·42 | **9·09** | 8·81 | 9·39 | **4·25** | 3·80 | 4·58 | **8·88** | 8·68 | 9·16 |
| Aug. 1 | **2·92** | 2·77 | 3·08 | **8·93** | 8·76 | 9·23 | **4·15** | 3·75 | 4·42 | **8·74** | 8·59 | 9·13 |
| " 8 | **2·94** | 2·80 | 3·18 | **8·77** | 8·68 | 8·97 | **4·03** | 3·60 | 4·72 | **8·76** | 8·53 | 8·98 |
| " 15 | **2·91** | 2·57 | 3·10 | **8·84** | 8·75 | 8·93 | **3·87** | 3·60 | 4·30 | **8·75** | 8·62 | 8·88 |
| " 22 | **2·89** | 2·74 | 2·98 | **8·83** | 8·76 | 8·91 | **4·10** | 3·70 | 4·60 | **8·84** | 8·66 | 9·00 |
| " 29 | **3·10** | 2·95 | 3·35 | **8·91** | 8·80 | 9·02 | **4·07** | 3·87 | 4·28 | **8·74** | 8·64 | 8·86 |
| Sept 5 | **3·12** | 2·90 | 3·38 | **8·71** | 8·63 | 8·79 | **4·13** | 3·70 | 4·32 | **8·54** | 8·41 | 8·75 |
| " 9 (4 days) | **3·37** | 3·20 | 3·60 | **8·75** | 8·72 | 8·83 | **4·52** | 4·20 | 5·08 | **8·50** | 8·45 | 8·55 |
| Mean | **2·96** | 2·42 | 3·60 | **8·93** | 8·63 | 9·39 | **4·12** | 3·47 | 5·08 | **8·83** | 8·41 | 9·31 |

Taking the weekly averages, it will be noted that the quality of the mixed milk was remarkably constant throughout the experiment until the end of August, when the fat-content showed a decided improvement, but a marked deterioration occurred in the case of the solids-not-fat.[1] The averages for

[1] These changes were accompanied by a marked accentuation of the falling off

the whole experiment were 2·96 per cent of fat, and 8·93 per cent of solids-not-fat in the morning milk, and 4·12 per cent of fat, and 8·83 per cent of solids-not-fat in the evening milk.

These averages are remarkably similar to those obtained in 1902 and 1903.

It will further be noticed that the weekly average percentage of fat in the morning milk ranged from 2·74 per cent (June 20) to 3·37 per cent (September 9), and was invariably below 3 per cent until the end of August (August 23 to 29)—the daily results ranging from 2·42 per cent (June 20) to 3·60 per cent (September 8), whilst the weekly means recorded in the case of the evening milk ranged from 3·87 per cent (August 9 to 15) to 4·52 per cent (September 9)—the daily results ranging from 3 47 per cent (June 21) to 5 08 per cent (September 6).

The weekly average in the case of the solids-not-fat varied in the morning milk from 8·71 per cent (August 30 to September 5) to 9·11 per cent (July 5 to 11), and in the evening milk from 8·50 per cent (September 6 to 9) to 9 06 per cent (June 7 to 13).

In view of the practical importance of these data, the number of days during each successive week on which the *morning milk* failed to reach the "standard" of 3 per cent of fat are recorded in the following table —

| Week ending | | No of days under 3 fat |
|---|---|---|
| June 13 | | 3 |
| " 20 | | 5 |
| " 27 | | 3 |
| July 4 | | 3 |
| " 11 | | 6 |
| " 18 | | 7 |
| " 25 | | 4 |
| Aug 1 | | 4 |
| " 8 | | 4 |
| " 15 | | 4 |
| " 22 | | 5 |
| " 29 | | 1 |
| Sept 5 | | 1 |
| " 9 (four days) | | 0 |
| | Total | 50 |

Thus the fat in the morning milk was below 3 per cent on no fewer than 50 of the 95 days on which samples were taken, the failure to reach the "standard" being almost a daily occurrence in the earlier part of July, but quite exceptional after the third week of August

in yield. This may be seen in reference to Table XXV, p 347, which contains data referring to the mixed milk of the fourteen cows employed for the experiment previously discussed.

The solids-not-fat fell below the "standard" of 8·5 per cent on two occasions only—viz., August 31 and September 5—in both cases in the evening milk, although indeed for the last ten days of the experiment the standard was only very narrowly exceeded. This falling off has been already alluded to (p. 326), and might probably have been considerably minimised had the conditions of the experiment admitted of suitable measures being adopted.

The lowness of the percentage of fat in the morning milk is in complete accord with the observations of the preceding three summers.[1] Out of more than 300 samples of the mixed morning milk of the Garforth herd, analysed during the summers of 1901-4, not more than 30 per cent have contained 3 per cent or more of fat; and indeed the proportion is even lower in the case of the samples collected in the months of June and July. During these years changes have been made from time to time in the herd, so that the low fat-content cannot be attributed to any particular individual or individuals in the herd. Moreover, evidence is gradually accumulating, from experiments carried out elsewhere, *that when the conditions are similar to those at Garforth, particularly with respect to the breed of cows and the times of milking, results of a precisely similar nature are usually obtained.* As cases in point may be cited the investigations recently carried out at Cambridge and Reading, already alluded to (p. 296). In the former, the percentage of fat in the mixed morning milk of three cross-shorthorn cows fell from a mean of 3·67 per cent, recorded when milking took place at equal intervals, to a mean of 2·33 per cent when the night interval was extended to 16 hours, the corresponding values for the evening milk being 3·45 and 4·47 respectively.

In the Reading experiments the mixed morning milk of eight shorthorn cows, milked at intervals of 15 and 9 hours respectively, contained 3 per cent or more of fat on *four* mornings only out of forty-two.[2]

The Garforth results require no stronger confirmation than is afforded by these two experiments alone. They, moreover, effectually refute the hypothesis that the poverty in fat of the morning milk may be due to more or less localised conditions, such as climate and the nature of the pastures.

[1] Cf. 'Trans.,' 1902, p. 298; 1903, p. 180; 1904, p. 305.

[2] In the report it is suggested that the poverty in fat of the milk is "in great measure" accounted for by the fact that most of the cows were quite newly calven at the commencement of the experiment It should also be noted that the cows received large quantities of watery food (mangels). These were undoubtedly contributory causes; but in the light of the Garforth and Cambridge experiments it is most probable that the low fat-content of the morning milk was in greatest measure due to the long night interval prior to the morning milking. Indeed, in a private communication Mr Percival of Reading informs the writer that the owner of the herd "has since been compelled to add an hour to the shorter interval in order to get the milk up to standard in the morning."

*There can be no doubt that it is determined almost entirely by the great inequality in the intervals between milkings.* If the conditions at Garforth permitted of milking being carried out always at intervals of 12 hours, it is practically certain that the morning milk would rarely, if ever, contain less than 3 per cent of fat at any period of the year.

Where very unequal intervals are necessitated, then, apart from judicious arrangement of the times of calving, the only ways apparently in which any marked improvement of a permanent nature in the quality of the morning milk may be ensured, consist either in introducing into the herd a suitable proportion of cows of breeds noted for the high quality of their milk (say one or two Jerseys to every ten shorthorns), or by greater care being exercised in the selection of the cows to ensure that no cow which persistently yields milk of low quality shall be included in the herd. It is an open question, however, whether either of these methods, which would involve serious additional expense to the farmer, is generally practicable. In this connection attention may be directed to the marked differences in the quality of the morning milk of certain of the cows used for the present experiment—cows, namely, of equal age and period of lactation—*e.g.*, compare Nos. 9 and 16, 5 and 7, 17 and 19.

The prospect of effecting any substantial permanent improvement by means of special foods or special methods of feeding is, in the light of our present knowledge, very slight.

In conclusion, the writer would acknowledge his indebtedness to his colleague, Mr E. Percy Kaye, B.Sc., for valuable assistance in the preparation of the diagrams, and to Prof. R. S. Seton, B.Sc., for kindly criticism.

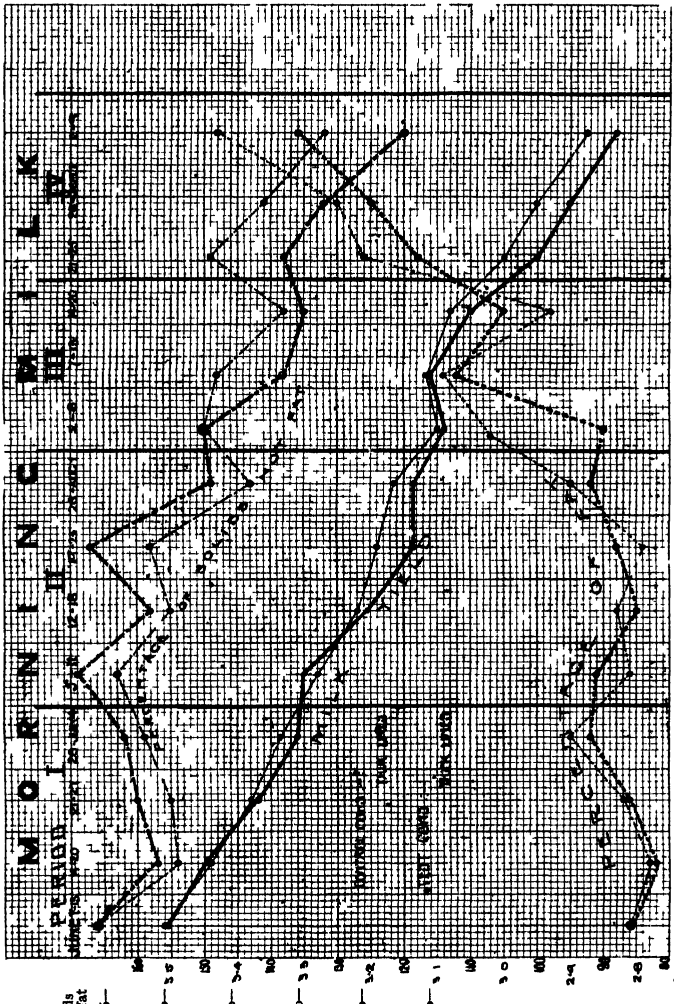



Fig 56 —Diagram showing Fluctuations in Yield and Composition of Morning Milk (Weekly Means)

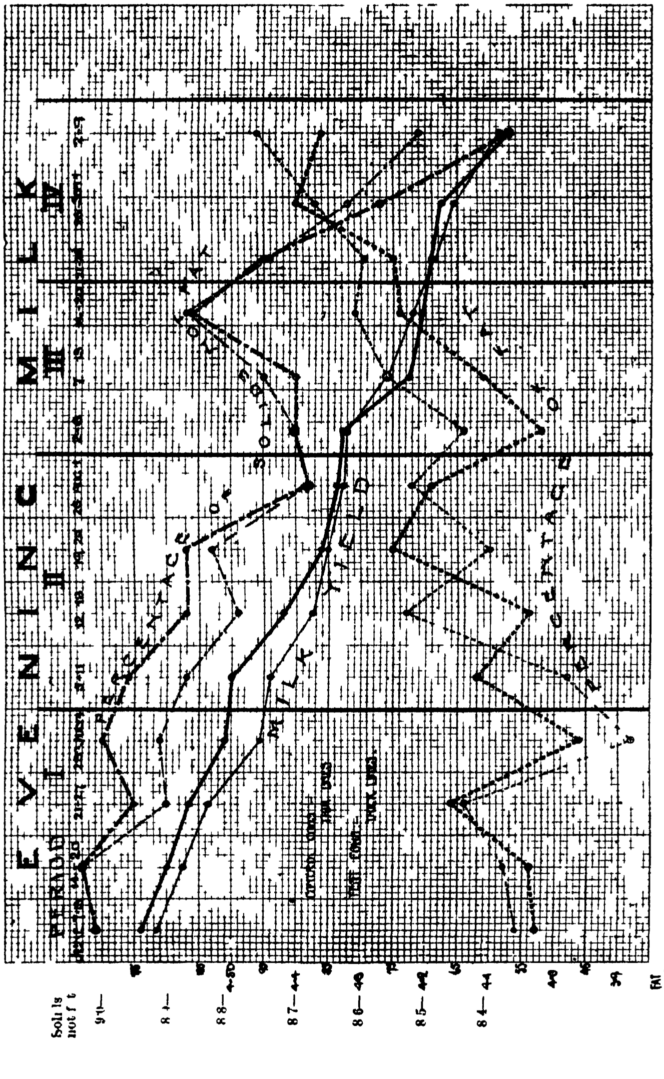



Fig 57 —Diagram showing Fluctuations in Yield and Composition of Evening Milk (Weekly Means)

## TABLE XI.—COW No. 2. (Control Group.) Age, 4 years.

Period of Lactation (to June 7), 3 weeks. Weight on July 4, 11 cwt 1 qr. 6 lb.; Aug. 2, 11 cwt. 1 qr. 8 lb.; Sept. 12, 10 cwt. 3 qr. 20 lb.

MEAN DAILY RESULTS.

| Period. | | Milk yield A.M. | Milk yield P.M. | Fat A.M. | Fat P.M. | Solids-not-fat A.M. | Solids-not-fat P.M. | Total *weight* of fat A.M. | Total *weight* of fat P.M. | Total *weight* of solids-not-fat A.M. | Total *weight* of solids-not-fat P.M. | Mixed morning and evening milk Yield | Mixed morning and evening milk Fat | Mixed morning and evening milk S-N-F | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | lb. | lb. | % | % | % | % | lb. | lb | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 26·9 | 19·1 | 2·82 | 4·92 | 9·20 | 8·95 | 0·757 | 0·943 | 2·471 | 1·711 | 46·0 | 3·70 | 9·09 | Received daily— |
| | " 14– " 20 | 26·7 | 18·5 | 2·78 | 4·78 | 8·96 | 8·99 | 0·741 | 0·886 | 2·389 | 1·661 | 45·2 | 3·60 | 8·97 | 2 lb. undec. cotton-cake } given morn. |
| | " 21– " 27 | 26·1 | 18·4 | 2·85 | 4·18 | 8·85 | 8·93 | 0·741 | 0·770 | 2·309 | 1·645 | 44·5 | 3·40 | 8·89 | 3 " maize-meal } and night. |
| | " 28–July 4 | 25·3 | 17·2 | 2·83 | 4·12 | 9·04 | 8·84 | 0·717 | 0·701 | 2·286 | 1·521 | 42·5 | 3·34 | 8·97 | At pasture day and night. |
| Mean results for first period | | **26·2** | **18·3** | **2·82** | **4·50** | **9·01** | **8·93** | **0·739** | **0·825** | **2·364** | **1·635** | **44·5** | **3·51** | **8·98** | Ratio, A.M. : P.M. { Yield, 1·44 : 1. Fat, %, 1 : 1·60. |
| II. | July 5–July 11 | 25·0 | 16·6 | 2·75 | 4·13 | 9·03 | 8·83 | 0·688 | 0·687 | 2·260 | 1·479 | 41·6 | 3·30 | 8·98 | Stall food as in Period I. |
| | " 12– " 18 | 24·4 | 14·9 | 2·70 | 4·18 | 8·87 | 8·62 | 0·660 | 0·624 | 2·166 | 1·287 | 39·3 | 3·26 | 8·77 | At pasture day and night. |
| | " 19– " 25 | 23·3 | 15·0 | 2·61 | 4·12 | 8·76 | 8·75 | 0·608 | 0·619 | 2·041 | 1·313 | 38·3 | 3·20 | 8·75 | |
| | " 26–Aug. 1 | 22·6 | 14·8 | 2·81 | 4·16 | 8·65 | 8·55 | 0·636 | 0·616 | 1·953 | 1·264 | 37·4 | 3·35 | 8·61 | |
| Mean results for second period | | **23·8** | **15·3** | **2·72** | **4·15** | **8·83** | **8·69** | **0·648** | **0·636** | **2·105** | **1·336** | **39·2** | **3·28** | **8·78** | Ratio, A.M. : P.M. { Yield, 1·56 : 1. Fat, %, 1 : 1·53. |
| III. | Aug. 2–Aug. 6 | 21·4 | 13·8 | 2·93 | 3·92 | 8·87 | 8·65 | 0·626 | 0·542 | 1·898 | 1·193 | 35·2 | 3·32 | 8·78 | Stall food as in Period I. |
| | " 7– " 13 | 21·6 | 13·0 | 2·84 | 4·10 | 8·71 | 8·66 | 0·613 | 0·534 | 1·881 | 1·144 | 34·6 | 3·31 | 8·75 | At pasture day and night. |
| | " 14– " 20 | 20·5 | 11·9 | 2·86 | 4·07 | 8·65 | 8·75 | 0·588 | 0·492 | 1·773 | 1·039 | 32·4 | 3·30 | 8·69 | |
| Mean results for third period | | **21·2** | **12·8** | **2·87** | **4·04** | **8·73** | **8·69** | **0·607** | **0·517** | **1·846** | **1·118** | **34·0** | **3·31** | **8·74** | Ratio, A.M. : P.M. { Yield, 1·66 : 1. Fat, %, 1 : 1·41. |
| IV. | Aug. 21–Aug. 25 | 19·7 | 11·8 | 2·83 | 4·20 | 8·61 | 8·63 | 0·558 | 0·493 | 1·695 | 1·013 | 31·5 | 3·34 | 8·61 | Stall food as in Period I. |
| | " 26–Sept. 1 | 18·9 | 11·0 | 3·29 | 4·03 | 8·57 | 8·55 | 0·620 | 0·443 | 1·622 | 0·940 | 29·9 | 3·51 | 8·56 | At pasture day and night. |
| | Sept. 2– " 9 | 18·1 | 10·3 | 3·42 | 4·07 | 8·49 | 8·48 | 0·621 | 0·420 | 1·539 | 0·875 | 28·4 | 3·66 | 8·49 | |
| Mean results for fourth period | | **18·8** | **10·9** | **3·23** | **4·09** | **8·55** | **8·54** | **0·605** | **0·446** | **1·607** | **0·932** | **29·7** | **3·53** | **8·54** | Ratio, A.M. : P.M. { Yield, 1·73 : 1. Fat, %, 1 : 1·27. |

## TABLE XII.—COW No. 5. (Control Group.) Age, 6 years.

Period of Lactation (to June 7), 14 weeks. Weight on July 4, 11 cwt. 1 qr. 12 lb.; Aug. 2, 11 cwt. 2 qr. 10 lb.; Sept. 12, 12 cwt. 0 qr. 10 lb.

MEAN DAILY RESULTS

| Period. | | Milk yield | | Fat | | Solids-not-fat. | | Total *weight* of fat | | Total *weight* of solids-not-fat. | | Mixed morning and evening milk. | | | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.-N.-F. | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 16·7 | 12·4 | 3·13 | 4·05 | 8·97 | 8·93 | 0·525 | 0·500 | 1·500 | 1·102 | 29·1 | 3·51 | 8·95 | Received daily— 2 lb. undec. cotton-cake, 3 " maize-meal, given morn. and night. At pasture day and night. |
| | " 14– " 20 | 15·6 | 11·6 | 3·14 | 4·09 | 9·00 | 8·94 | 0·491 | 0·474 | 1·409 | 1·035 | 27·2 | 3·55 | 8·98 | |
| | " 21– " 27 | 15·3 | 11·3 | 3·21 | 4·31 | 8·94 | 8·94 | 0·492 | 0·485 | 1·370 | 1·011 | 26·6 | 3·68 | 8·94 | |
| | " 28–July 4 | 15·1 | 10·4 | 3·17 | 4·15 | 8·94 | 8·92 | 0·477 | 0·432 | 1·349 | 0·929 | 25·5 | 3·57 | 8·93 | |
| Mean results for first period | | **15·7** | **11·4** | **3·16** | **4·15** | **8·96** | **8·93** | **0·496** | **0·473** | **1·407** | **1·020** | **27·1** | **3·58** | **8·95** | Ratio, A.M. : P.M. Yield, 1·38 : 1. Fat, %, 1 : 1·31. |
| II. | July 5–July 11 | 13·4 | 9·6 | 3·19 | 4·14 | 9·05 | 8·98 | 0·426 | 0·398 | 1·210 | 0·876 | 23·0 | 3·58 | 9·02 | Stall food as in Period I. At pasture day and night. |
| | " 12– " 18 | 13·6 | 9·8 | 3·26 | 4·35 | 8·95 | 8·81 | 0·443 | 0·426 | 1·214 | 0·862 | 23·4 | 3·71 | 8·87 | |
| | " 19– " 25 | 13·1 | 9·2 | 3·19 | 4·36 | 9·08 | 8·92 | 0·420 | 0·402 | 1·194 | 0·822 | 22·3 | 3·69 | 9·04 | |
| | " 26–Aug. 1 | 12·9 | 9·3 | 3·16 | 4·52 | 8·81 | 8·72 | 0·409 | 0·420 | 1·139 | 0·810 | 22·2 | 3·73 | 8·78 | |
| Mean results for second period | | **13·3** | **9·5** | **3·20** | **4·34** | **8·97** | **8·86** | **0·425** | **0·412** | **1·189** | **0·843** | **22·8** | **3·68** | **8·93** | Ratio, A.M. : P.M. Yield, 1·40 : 1. Fat, %, 1 : 1·35. |
| III. | Aug. 2–Aug. 6 | 11·9 | 10·0 | 3·12 | 4·32 | 8·92 | 8·73 | 0·372 | 0·433 | 1·061 | 0·873 | 21·9 | 3·68 | 8·83 | Stall food as in Period I. At pasture day and night. |
| | " 7– " 13 | 11·8 | 9·3 | 3·29 | 4·61 | 8·93 | 8·66 | 0·388 | 0·428 | 1·054 | 0·804 | 21·1 | 3·87 | 8·81 | |
| | " 14– " 20 | 11·7 | 8·1 | 3·28 | 4·67 | 8·79 | 8·89 | 0·384 | 0·381 | 1·028 | 0·720 | 19·8 | 3·86 | 8·83 | |
| Mean results for third period | | **11·8** | **8·9** | **3·25** | **4·57** | **8·86** | **8·78** | **0·383** | **0·408** | **1·044** | **0·782** | **20·7** | **3·82** | **8·82** | Ratio, A.M. : P.M. Yield, 1·33 : 1. Fat, %, 1 : 1·41. |
| IV. | Aug. 21–Aug. 25 | 9·6 | 6·9 | 3·70 | 4·64 | 8·96 | 8·56 | 0·356 | 0·318 | 0·862 | 0·589 | 16·5 | 4·09 | 8·78 | Stall food as in Period I. Also at evening milking hay *ad lib.* for the night. At pasture *day only*. |
| | " 26–Sept. 1 | 9·6 | 6·3 | 3·83 | 4·86 | 8·73 | 8·39 | 0·367 | 0·308 | 0·837 | 0·532 | 15·9 | 4·24 | 8·61 | |
| | Sept. 2– " 9 | 9·3 | 5·6 | 3·83 | 4·67 | 8·73 | 8·37 | 0·357 | 0·263 | 0·812 | 0·471 | 14·9 | 4·16 | 8·61 | |
| Mean results for fourth period | | **9·5** | **6·1** | **3·80** | **4·73** | **8·78** | **8·42** | **0·360** | **0·290** | **0·833** | **0·520** | **15·6** | **4·17** | **8·65** | Ratio, A.M. : P.M. Yield, 1·55 : 1. Fat, %, 1 : 1·24. |

## TABLE XIII.—COW No. 6. (CONTROL GROUP.) AGE, 5 years.

PERIOD OF LACTATION (to June 7), 21 weeks. WEIGHT on July 4, 11 cwt. 0 qr. 16 lb.; Aug. 2, 11 cwt. 1 qr. 20 lb.; Sept. 12, 11 cwt. 1 qr. 22 lb.

MEAN DAILY RESULTS

| PERIOD. | Milk yield | | Fat | | Solids-not-fat. | | Total *weight* of fat | | Total *weight* of solids-not-fat | | Mixed morning and evening milk | | | FOOD, ETC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat. | S-N-F | |
| | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. June 7–June 13 | 16.0 | 11.4 | 3.54 | 4.46 | 9.18 | 9.08 | 0.566 | 0.507 | 1.468 | 1.031 | 27.4 | 3.92 | 9.12 | Received daily— |
| I. " 14– " 20 | 16.2 | 11.5 | 3.48 | 4.42 | 9.04 | 9.08 | 0.565 | 0.509 | 1.465 | 1.043 | 27.7 | 3.88 | 9.05 | 2 lb. undec. cotton-cake } given morn. |
| I. " 21– " 27 | 15.4 | 11.4 | 3.57 | 4.64 | 9.12 | 9.00 | 0.550 | 0.524 | 1.407 | 1.027 | 26.8 | 4.01 | 9.08 | 3 " maize-meal } and night. |
| I. " 28–July 4 | 15.3 | 11.0 | 3.72 | 4.39 | 9.18 | 9.04 | 0.568 | 0.482 | 1.403 | 0.995 | 26.3 | 4.00 | 9.12 | At pasture day and night. |
| **Mean results for first period** | **15.7** | **11.3** | **3.58** | **4.48** | **9.13** | **9.05** | **0.562** | **0.506** | **1.436** | **1.024** | **27.0** | **3.95** | **9.09** | RATIO, A.M. : P.M. { Yield, 1.39 : 1. Fat, %, 1 : 1.25. |
| II. July 5–July 11 | 15.0 | 11.4 | 3.58 | 4.41 | 9.15 | 8.93 | 0.537 | 0.500 | 1.373 | 1.014 | 26.4 | 3.93 | 9.04 | Stall food as in Period I. |
| II. " 12– " 18 | 14.4 | 10.9 | 3.71 | 4.62 | 9.15 | 9.04 | 0.535 | 0.505 | 1.320 | 0.988 | 25.3 | 4.11 | 9.12 | At pasture day and night. |
| II. " 19– " 25 | 13.9 | 10.3 | 3.70 | 4.68 | 9.14 | 8.95 | 0.512 | 0.482 | 1.267 | 0.932 | 24.2 | 4.11 | 9.09 | |
| II. " 26– Aug. 1 | 13.1 | 10.4 | 3.63 | 4.92 | 9.05 | 8.84 | 0.477 | 0.514 | 1.189 | 0.923 | 23.6 | 4.20 | 8.95 | |
| **Mean results for second period** | **14.1** | **10.8** | **3.66** | **4.66** | **9.12** | **8.94** | **0.515** | **0.500** | **1.288** | **0.964** | **24.9** | **4.04** | **9.05** | RATIO, A.M. : P.M. { Yield, 1.31 : 1. Fat, %, 1 : 1.27. |
| III. Aug. 2–Aug. 6 | 13.0 | 9.7 | 3.78 | 4.83 | 9.18 | 8.90 | 0.493 | 0.471 | 1.193 | 0.864 | 22.7 | 4.25 | 9.06 | Stall food as in Period I. |
| III. " 7– " 13 | 12.6 | 9.6 | 3.84 | 4.99 | 9.04 | 8.89 | 0.486 | 0.482 | 1.143 | 0.857 | 22.3 | 4.34 | 8.97 | At pasture day and night. |
| III. " 14– " 20 | 12.9 | 9.5 | 3.55 | 5.11 | 9.03 | 9.02 | 0.457 | 0.486 | 1.161 | 0.849 | 22.4 | 4.21 | 9.02 | |
| **Mean results for third period** | **12.8** | **9.6** | **3.72** | **4.99** | **9.07** | **8.94** | **0.477** | **0.481** | **1.163** | **0.856** | **22.4** | **4.27** | **9.01** | RATIO, A.M. : P.M. { Yield, 1.33 : 1. Fat, %, 1 : 1.35. |
| IV. Aug. 21–Aug. 25 | 11.6 | 9.4 | 3.92 | 4.96 | 9.13 | 8.98 | 0.456 | 0.464 | 1.062 | 0.842 | 21.0 | 4.38 | 9.07 | Stall food as in Period I. |
| IV. " 26–Sept. 1 | 11.3 | 8.3 | 3.93 | 5.00 | 9.00 | 8.72 | 0.443 | 0.415 | 1.016 | 0.723 | 19.6 | 4.38 | 8.87 | At pasture day and night. |
| IV. Sept. 2– " 9 | 10.3 | 7.3 | 4.20 | 5.21 | 8.84 | 8.60 | 0.433 | 0.380 | 0.915 | 0.627 | 17.6 | 4.62 | 8.76 | |
| **Mean results for fourth period** | **11.0** | **8.2** | **4.03** | **5.07** | **8.97** | **8.74** | **0.442** | **0.413** | **0.987** | **0.714** | **19.2** | **4.48** | **8.88** | RATIO, A.M. : P.M. { Yield, 1.35 : 1. Fat, %, 1 : 1.26. |

## TABLE XIV.—COW No. 7. (Test Group.) Age, 6 years.

Period of Lactation (to June 7), 13 weeks  Weight on July 4, 11 cwt. 3 qr. 0 lb.; Aug 2, 11 cwt 2 qr. 4 lb.; Sept 12, 11 cwt. 1 qr. 10 lb.

MEAN DAILY RESULTS

| Period | | Milk yield A.M. | Milk yield P.M. | Fat A.M. | Fat P.M. | Solids not-fat A.M. | Solids not-fat P.M. | Total weight of fat A.M. | Total weight of fat P.M. | Total weight of solids not-fat A.M. | Total weight of solids not-fat P.M. | Mixed morning and evening milk. Yield | Mixed Fat | Mixed S.N-F | Food, Etc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | lb | lb | % | % | % | % | lb | lb | lb | lb | lb | % | % | |
| I | June 7–June 13 | 22·3 | 18·4 | 2·85 | 4·19 | 9·20 | 9·08 | 0·635 | 0·775 | 2·049 | 1·669 | 40·7 | 3·46 | 9·14 | Received daily— 2 lb. undec. cotton-cake, 3 " maize-meal } given morn. and night. At pasture day and night. |
| | " 14– " 20 | 22·0 | 18·8 | 2·45 | 4·05 | 9·05 | 9·04 | 0·537 | 0·763 | 1·990 | 1·700 | 40·8 | 3·19 | 9·04 | |
| | " 21– " 27 | 20·9 | 17·0 | 2·78 | 4·33 | 9·12 | 8·92 | 0·584 | 0·726 | 1·906 | 1·517 | 37·9 | 3·46 | 9·03 | |
| | " 28–July 4 | 19·6 | 16·6 | 2·80 | 3·93 | 9·03 | 9·02 | 0·550 | 0·651 | 1·770 | 1·495 | 36·2 | 3·32 | 9·02 | |
| **Mean results for first period** | | **21·1** | **17·6** | **2·74** | **4·10** | **9·10** | **9·01** | **0·577** | **0·719** | **1·914** | **1·578** | **38·6** | **3·36** | **9·04** | Ratio, A.M. : P.M. { Yield, 1·20 : 1. Fat, %, 1 : 1·50. |
| II | July 5–July 11 | 20·2 | 16·5 | 2·97 | 4·22 | 9·08 | 9·02 | 0·601 | 0·699 | 1·831 | 1·487 | 36·7 | 3·54 | 9·04 | Received daily— 2 lb. undec. cotton-cake, 3 " decort. " " } all at *morning* milking. At pasture day and night |
| | " 12– " 18 | 18·9 | 14·5 | 2·84 | 4·05 | 8·86 | 9·00 | 0·549 | 0·596 | 1·674 | 1·307 | 33·4 | 3·43 | 8·93 | |
| | " 19– " 25 | 16·5 | 13·5 | 2·64 | 4·35 | 9·06 | 8·88 | 0·438 | 0·602 | 1·495 | 1·199 | 30·0 | 3·47 | 8·98 | |
| | " 26–Aug. 1 | 18·4 | 13·3 | 2·74 | 4·33 | 8·92 | 8·83 | 0·508 | 0·580 | 1·646 | 1·172 | 31·7 | 3·43 | 8·89 | |
| **Mean results for second period** | | **18·4** | **14·4** | **2·79** | **4·25** | **8·99** | **8·92** | **0·519** | **0·618** | **1·654** | **1·282** | **32·8** | **3·47** | **8·96** | Ratio, A.M. : P.M. { Yield, 1·28 : 1. Fat, %, 1 : 1·53. |
| III | Aug. 2–Aug. 6 | 17·5 | 12·8 | 2·54 | 3·83 | 9·03 | 8·65 | 0·447 | 0·510 | 1·581 | 1·201 | 30·3 | 3·16 | 8·87 | Received daily— 2 lb undec. cotton-cake, 3 " maize-meal } *all at morning milking.* At pasture day and night. |
| | " 7– " 13 | 17·4 | 10·6 | 3·08 | 4·01 | 8·65 | 8·73 | 0·539 | 0·434 | 1·504 | 0·926 | 28·0 | 3·48 | 8·67 | |
| | " 14– " 20 | 17·2 | 10·9 | 2·77 | 4·49 | 8·64 | 8·89 | 0·484 | 0·493 | 1·490 | 0·969 | 28·1 | 3·48 | 8·75 | |
| **Mean results for third period** | | **17·4** | **11·4** | **2·77** | **4·11** | **8·78** | **8·78** | **0·486** | **0·479** | **1·524** | **1·020** | **28·8** | **3·35** | **8·77** | Ratio, A.M. : P.M. { Yield, 1·53 : 1. Fat, %, 1 : 1·48. |
| IV. | Aug. 21–Aug. 25 | 13·6 | 10·8 | 2·84 | 3·65 | 8·64 | 8·73 | 0·388 | 0·399 | 1·176 | 0·946 | 24·4 | 3·23 | 8·70 | Stall food as in Period I. At pasture day and night. |
| | " 26–Sept. 1 | 12·1 | 11·1 | 2·74 | 4·50 | 8·75 | 8·67 | 0·334 | 0·536 | 1·057 | 0·956 | 23·2 | 3·75 | 8·70 | |
| | Sept. 2– " 9 | 11·8 | 8·7 | 2·84 | 3·97 | 8·63 | 8·54 | 0·339 | 0·342 | 1·016 | 0·741 | 20·5 | 3·35 | 8·60 | |
| **Mean results for fourth period** | | **12·4** | **10·1** | **2·80** | **4·08** | **8·68** | **8·66** | **0·350** | **0·433** | **1·080** | **0·881** | **22·5** | **3·47** | **8·67** | Ratio, A.M. : P.M. { Yield, 1·23 : 1. Fat, %, 1 : 1·46. |

## TABLE XV.—COW No. 8. (Control Group.) Age, 6 years.

Period of Lactation (to June 7), 5 weeks. Weight on July 4, 11 cwt. 3 qr. 0 lb., Aug. 2, 11 cwt. 3 qr. 8 lb.; Sept. 12, 12 cwt. 0 qr. 0 lb.

MEAN DAILY RESULTS.

| Period | | Milk yield | | Fat | | Solids-not-fat | | Total weight of fat | | Total weight of solids not-fat | | Mixed morning and evening milk | | | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.N.F. | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 23.5 | 16.6 | 2.62 | 3.89 | 9.19 | 9.29 | 0.616 | 0.647 | 2.159 | 1.544 | 40.1 | 3.15 | 9.23 | Received daily— 2 lb. undec. cotton-cake given morn. and night. |
| | " 14– " 20 | 22.4 | 15.1 | 2.62 | 3.63 | 8.97 | 9.03 | 0.584 | 0.550 | 2.006 | 1.367 | 37.5 | 3.03 | 9.00 | 2 " maize-meal given morn. and night. |
| | " 21– " 27 | 20.4 | 14.9 | 2.76 | 4.62 | 8.88 | 8.81 | 0.572 | 0.692 | 1.813 | 1.314 | 35.3 | 3.58 | 8.86 | At pasture day and night. |
| | " 28–July 4 | 19.6 | 13.5 | 2.84 | 3.63 | 8.98 | 8.82 | 0.557 | 0.491 | 1.758 | 1.191 | 33.1 | 3.17 | 8.92 | |
| Mean results for first period | | **21.3** | **14.8** | **2.72** | **3.89** | **8.99** | **8.95** | **0.579** | **0.580** | **1.916** | **1.333** | **36.1** | **3.21** | **8.99** | Ratio A.M. : P.M. Yield, 1.48 : 1. Fat, %, 1 : 1.43. |
| II. | July 5–July 11 | 18.6 | 12.6 | 2.78 | 3.78 | 9.08 | 9.08 | 0.521 | 0.482 | 1.688 | 1.128 | 31.2 | 3.22 | 9.03 | Stall food as in Period I. |
| | " 12– " 18 | 17.6 | 12.6 | 2.72 | 4.42 | 9.00 | 8.94 | 0.479 | 0.561 | 1.582 | 1.127 | 30.2 | 3.44 | 8.97 | At pasture day and night |
| | " 19– " 25 | 17.6 | 11.6 | 2.55 | 3.70 | 9.15 | 8.93 | 0.447 | 0.430 | 1.608 | 1.034 | 29.2 | 3.01 | 9.05 | |
| | " 26–Aug. 1 | 17.3 | 10.4 | 2.81 | 3.80 | 8.90 | 8.78 | 0.487 | 0.394 | 1.539 | 0.910 | 27.7 | 3.18 | 8.84 | |
| Mean results for second period | | **17.7** | **11.7** | **2.71** | **3.91** | **9.03** | **8.91** | **0.483** | **0.463** | **1.601** | **1.043** | **29.4** | **3.22** | **8.99** | Ratio, A.M. : P.M. Yield, 1.51 : 1. Fat %, 1 : 1.44. |
| III. | Aug. 2–Aug. 6 | 16.6 | 10.2 | 3.11 | 3.83 | 8.84 | 8.78 | 0.536 | 0.390 | 1.468 | 0.909 | 26.8 | 3.46 | 8.87 | Stall food as in Period I. |
| | " 7– " 13 | 16.7 | 10.3 | 2.94 | 3.89 | 8.95 | 8.82 | 0.507 | 0.402 | 1.499 | 0.912 | 27.0 | 3.37 | 8.93 | At pasture day and night |
| | " 14– " 20 | 16.7 | 9.7 | 2.74 | 4.10 | 8.83 | 8.92 | 0.458 | 0.396 | 1.476 | 0.860 | 26.4 | 3.23 | 8.85 | |
| Mean results for third period | | **16.7** | **10.0** | **2.91** | **3.96** | **8.87** | **8.86** | **0.496** | **0.396** | **1.482** | **0.890** | **26.7** | **3.34** | **8.88** | Ratio, A.M. : P.M. Yield, 1.67 : 1. Fat, %, 1 : 1.36. |
| IV. | Aug. 21–Aug. 25 | 15.6 | 9.5 | 2.89 | 3.67 | 8.79 | 8.78 | 0.450 | 0.352 | 1.371 | 0.834 | 25.1 | 3.19 | 8.79 | Stall food as in Period I |
| | " 26–Sept. 1 | 14.4 | 8.9 | 2.81 | 4.06 | 8.67 | 8.59 | 0.405 | 0.359 | 1.245 | 0.761 | 23.3 | 3.28 | 8.61 | At pasture day and night. |
| | Sept. 2– " 9 | 13.2 | 8.0 | 3.23 | 3.86 | 8.57 | 8.55 | 0.424 | 0.310 | 1.130 | 0.634 | 21.2 | 3.46 | 8.56 | |
| Mean results for fourth period | | **14.2** | **8.7** | **3.00** | **3.88** | **8.66** | **8.63** | **0.424** | **0.338** | **1.231** | **0.748** | **22.9** | **3.33** | **8.64** | Ratio, A.M. : P.M. Yield, 1.63 : 1. Fat, %, 1 : 1.29. |

## TABLE XVI.—COW No. 9 (Control Group.) Age, 5 years.

Period of Lactation (to June 7), 9 weeks. Weight on July 4, 12 cwt 3 qr. 0 lb. Aug 2, 12 cwt. 2 qr 8 lb. Sept 12, 12 cwt. 2 qr. 18 lb.

### MEAN DAILY RESULTS.

| Period | | Milk yield | | Fat | | Solids-not-fat. | | Total weight of fat | | Total weight of solids-not-fat | | Mixed morning and evening milk | | | Food, Etc. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.N.F. | | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | | |
| I. | June 7–June 13 | 23·2 | 16·2 | 2·43 | 3·65 | 8·73 | 8·79 | 0·565 | 0·593 | 2·019 | 1·420 | 39·4 | 2·94 | 8·73 | Received daily— | |
| | " 14– " 20 | 20·6 | 17·7 | 2·67 | 4·06 | 8·70 | 8·85 | 0·551 | 0·639 | 1·790 | 1·385 | 36·3 | 3·28 | 8·75 | 2 lb undec. cotton-cake | given morn. |
| | " 21– " 27 | 19·9 | 14·5 | 2·67 | 3·84 | 8·90 | 8·76 | 0·534 | 0·558 | 1·767 | 1·271 | 34·4 | 3·18 | 8·83 | 3 " maize-meal | and night. |
| | " 28–July 4 | 19·2 | 13·2 | 2·77 | 3·65 | 8·98 | 8·91 | 0·532 | 0·482 | 1·726 | 1·177 | 32·4 | 3·13 | 8·96 | At pasture day and night | |
| Mean results for first period | | **20·6** | **14·8** | **2·64** | **3·80** | **8·83** | **8·82** | **0·544** | **0·564** | **1·818** | **1·306** | **35·4** | **3·13** | **8·83** | Ratio, A.M. : P.M. | Yield, 1·39 : 1. Fat, %, 1 : 1·40. |
| II. | July 5–July 11 | 19·3 | 13·2 | 2·71 | 3·84 | 8·97 | 8·64 | 0·524 | 0·507 | 1·731 | 1·142 | 32·5 | 3·17 | 8·84 | Stall food as in Period I. | |
| | " 12– " 18 | 18·1 | 12·5 | 2·58 | 4·05 | 8·83 | 8·74 | 0·467 | 0·509 | 1·595 | 1·093 | 30·6 | 3·19 | 8·78 | At pasture day and night. | |
| | " 19– " 25 | 18·2 | 12·3 | 2·70 | 3·95 | 9·07 | 8·90 | 0·495 | 0·488 | 1·656 | 1·098 | 30·5 | 3·22 | 9·03 | | |
| | " 26–Aug 1 | 17·7 | 11·5 | 2·76 | 4·12 | 8·66 | 8·48 | 0·489 | 0·474 | 1·528 | 0·976 | 29·2 | 3·30 | 8·58 | | |
| Mean results for second period | | **18·3** | **12·4** | **2·69** | **3·99** | **8·88** | **8·67** | **0·493** | **0·495** | **1·626** | **1·076** | **30·7** | **3·22** | **8·80** | Ratio, A.M. : P.M. | Yield, 1·48 : 1. Fat, %, 1 : 1·48. |
| III. | Aug. 2–Aug. 6 | 16·4 | 11·7 | 2·74 | 4·33 | 8·77 | 8·50 | 0·431 | 0·509 | 1·437 | 0·995 | 28·1 | 3·35 | 8·65 | Stall food as in Period I. | |
| | " 7– " 13 | 17·3 | 10·5 | 3·41 | 4·28 | 8·75 | 8·74 | 0·593 | 0·464 | 1·516 | 0·918 | 27·8 | 3·80 | 8·75 | At pasture day and night. | |
| | " 14– " 20 | 16·3 | 10·6 | 2·81 | 4·55 | 8·56 | 8·88 | 0·458 | 0·482 | 1·398 | 0·940 | 26·9 | 3·49 | 8·69 | | |
| Mean results for third period | | **16·7** | **10·9** | **3·00** | **4·41** | **8·69** | **8·73** | **0·503** | **0·485** | **1·452** | **0·949** | **27·6** | **3·58** | **8·70** | Ratio, A.M. : P.M. | Yield, 1·53 : 1. Fat, %, 1 : 1·47. |
| IV. | Aug 21–Aug. 25 | 16·5 | 8·6 | 3·41 | 4·44 | 8·72 | 8·81 | 0·564 | 0·379 | 1·437 | 0·759 | 25·1 | 3·75 | 8·77 | Stall food as in Period I. | |
| | " 26–Sept. 1 | 14·4 | 9·1 | 3·17 | 4·55 | 8·62 | 8·72 | 0·456 | 0·415 | 1·237 | 0·791 | 23·5 | 3·71 | 8·63 | At pasture day and night. | |
| | Sept 2– " 9 | 12·7 | 7·7 | 3·49 | 4·83 | 8·55 | 8·38 | 0·443 | 0·370 | 1·087 | 0·642 | 20·4 | 3·99 | 8·48 | | |
| Mean results for fourth period | | **14·3** | **8·4** | **3·35** | **4·62** | **8·62** | **8·64** | **0·479** | **0·389** | **1·234** | **0·728** | **22·7** | **3·82** | **8·64** | Ratio, A.M. : P.M. | Yield, 1·70 : 1. Fat, %, 1 : 1·38. |

## TABLE XVII.—COW No. 10. (TEST GROUP.) AGE, 5 years.

PERIOD OF LACTATION (to June 7), 21 weeks. WEIGHT on July 4, 11 cwt. 2 qr. 20 lb.; Aug. 2, 11 cwt. 2 qr. 22 lb.; Sept. 12, 11 cwt. 3 qr. 8 lb.

MEAN DAILY RESULTS.

| PERIOD. | Milk yield | | Fat | | Solids not-fat. | | Total *weight* of fat | | Total *weight* of solids-not-fat. | | Mixed morning and evening milk. | | | FOOD, ETC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.N.F. | |
| | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. June 7–June 13 | 16·3 | 9·4 | 3·35 | 3·59 | 8·71 | 8·89 | 0·548 | 0·332 | 1·421 | 0·823 | 25·7 | 3·42 | 8·74 | Received daily— |
| " 14– " 20 | 15·3 | 10·0 | 3·24 | 3·84 | 8·86 | 8·89 | 0·494 | 0·382 | 1·353 | 0·889 | 25·3 | 3·46 | 8·86 | 2 lb. undec. cotton-cake } given morn. |
| " 21– " 27 | 14·8 | 10·4 | 3·41 | 4·23 | 9·08 | 8·98 | 0·500 | 0·438 | 1·339 | 0·932 | 25·2 | 3·72 | 9·01 | 3 " maize-meal } and night. |
| " 28–July 4 | 14·7 | 10·1 | 3·26 | 3·89 | 9·02 | 8·82 | 0·480 | 0·394 | 1·327 | 0·893 | 24·8 | 3·53 | 8·95 | At pasture day and night. |
| **Mean results for first period** | **15·3** | **9·9** | **3·30** | **3·85** | **8·90** | **8·89** | **0·504** | **0·381** | **1·360** | **0·880** | **25·2** | **3·51** | **8·89** | RATIO, A.M. : P.M. { Yield, 1·55 : 1.<br>Fat, %, 1 : 1·17. |
| II. July 5–July 11 | 14·7 | 10·5 | 3·26 | 4·04 | 9·11 | 8·85 | 0·478 | 0·424 | 1·337 | 0·929 | 25·2 | 3·58 | 9·00 | Received daily— |
| " 12– " 18 | 13·6 | 9·4 | 3·45 | 3·81 | 9·00 | 8·87 | 0·470 | 0·359 | 1·227 | 0·835 | 23·0 | 3·60 | 8·96 | 2 lb. undec. cotton-cake } all at *morn-* |
| " 19– " 25 | 14·0 | 9·5 | 3·31 | 4·16 | 9·29 | 8·96 | 0·464 | 0·397 | 1·301 | 0·852 | 23·5 | 3·66 | 9·16 | 3 " decort. " " } *ing* milking. |
| " 26–Aug. 1 | 14·2 | 8·6 | 3·56 | 3·97 | 8·99 | 8·75 | 0·507 | 0·342 | 1·279 | 0·750 | 22·8 | 3·72 | 8·90 | At pasture day and night. |
| **Mean results for second period** | **14·1** | **9·5** | **3·41** | **3·99** | **9·09** | **8·85** | **0·481** | **0·380** | **1·283** | **0·841** | **23·6** | **3·65** | **9·00** | RATIO, A.M. : P.M. { Yield, 1·48 : 1.<br>Fat, %, 1 : 1·17. |
| III. Aug. 2–Aug. 6 | 14·0 | 8·9 | 3·37 | 3·98 | 8·79 | 8·76 | 0·471 | 0·355 | 1·231 | 0·780 | 22·9 | 3·61 | 8·78 | Received daily— |
| " 7– " 13 | 13·6 | 7·7 | 3·73 | 3·67 | 8·85 | 8·74 | 0·507 | 0·284 | 1·201 | 0·674 | 21·3 | 3·71 | 8·80 | 2 lb. undec. cotton-cake } *all at morn-* |
| " 14– " 20 | 13·0 | 7·9 | 3·51 | 4·21 | 8·79 | 8·94 | 0·457 | 0·334 | 1·146 | 0·705 | 20·9 | 3·78 | 8·86 | 3 " maize-meal } *ing milking* |
| | | | | | | | | | | | | | | At pasture day and night. |
| **Mean results for third period** | **13·4** | **8·1** | **3·55** | **3·98** | **8·81** | **8·83** | **0·476** | **0·322** | **1·183** | **0·713** | **21·5** | **3·71** | **8·82** | RATIO, A.M. : P.M. { Yield, 1·65 : 1.<br>Fat, %, 1 : 1·12. |
| IV. Aug. 21–Aug. 25 | 12·4 | 7·3 | 3·47 | 4·23 | 8·86 | 8·76 | 0·429 | 0·306 | 1·096 | 0·635 | 19·7 | 3·73 | 8·79 | Stall food as in Period III. |
| " 26–Sept. 1 | 11·1 | 7·8 | 3·66 | 4·25 | 8·87 | 8·53 | 0·408 | 0·334 | 0·984 | 0·668 | 18·9 | 3·93 | 8·74 | Also at evening milking hay *ad lib.* for the night. |
| Sept. 2– " 9 | 10·4 | 7·5 | 3·57 | 4·65 | 8·70 | 8·35 | 0·373 | 0·349 | 0·906 | 0·626 | 17·9 | 4·03 | 8·56 | At pasture *day only.* |
| **Mean results for fourth period** | **11·2** | **7·6** | **3·59** | **4·38** | **8·80** | **8·54** | **0·400** | **0·332** | **0·983** | **0·645** | **18·7** | **3·90** | **8·71** | RATIO, A.M. : P.M. { Yield, 1·48 : 1<br>Fat, %, 1 : 1·22. |

## TABLE XVIII.—COW No. 12. (Test Group.) Age, 6 years

Period of Lactation (to June 7), 6 weeks. Weight on July 4, 10 cwt. 1 qr. 18 lb., Aug. 2, 10 cwt. 1 qr. 0 lb., Sept. 12, 10 cwt. 1 qr. 16 lb.

### MEAN DAILY RESULTS.

| | Period | Milk yield | | Fat | | Solids-not-fat | | Total weight of fat | | Total weight of solids-not-fat | | Mixed morning and evening milk | | | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S.-N.F. | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 22·4 | 15·3 | 2·86 | 3·92 | 8·72 | 8·75 | 0·641 | 0·600 | 1·955 | 1·336 | 37·7 | 3·29 | 8·73 | Received daily—<br>2 lb. undec. cotton-cake } given morn.<br>3 " maize-meal } and night.<br>At pasture day and night. |
| | " 14– " 20 | 21·8 | 15·2 | 2·55 | 4·12 | 8·74 | 8·85 | 0·557 | 0·625 | 1·905 | 1·347 | 37·0 | 3·19 | 8·79 | |
| | " 21– " 27 | 20·2 | 14·6 | 2·57 | 3·71 | 8·82 | 8·68 | 0·517 | 0·540 | 1·777 | 1·264 | 34·8 | 3·04 | 8·74 | |
| | " 28–July 4 | 19·4 | 14·1 | 2·61 | 3·67 | 8·93 | 8·81 | 0·506 | 0·518 | 1·736 | 1·240 | 33·5 | 3·06 | 8·88 | |
| | **Mean results for first period** | **20·9** | **14·8** | **2·64** | **3·85** | **8·81** | **8·77** | **0·552** | **0·570** | **1·839** | **1·295** | **35·7** | **3·14** | **8·78** | Ratio, A.M. : P.M. { Yield, 1·41 : 1.<br>Fat, %, 1 : 1·46 |
| II. | July 5–July 11 | 19·0 | 14·2 | 2·65 | 3·80 | 8·97 | 8·78 | 0·505 | 0·543 | 1·705 | 1·252 | 33·2 | 3·16 | 8·91 | Received daily—<br>2 lb. undec. cotton-cake } all at *morn-*<br>3 " decort. " " } *ing* milking.<br>At pasture day and night. |
| | " 12– " 18 | 16·1 | 13·2 | 2·35 | 3·61 | 8·77 | 8·61 | 0·378 | 0·476 | 1·410 | 1·138 | 29·3 | 2·91 | 8·70 | |
| | " 19– " 25 | 14·9 | 11·3 | 2·56 | 3·93 | 8·95 | 8·57 | 0·384 | 0·442 | 1·335 | 0·966 | 26·2 | 3·15 | 8·78 | |
| | " 26–Aug. 1 | 14·8 | 11·2 | 2·51 | 3·86 | 8·44 | 8·09 | 0·374 | 0·433 | 1·245 | 0·900 | 26·0 | 3·11 | 8·25 | |
| | **Mean results for second period** | **16·1** | **12·4** | **2·51** | **3·80** | **8·77** | **8·51** | **0·407** | **0·471** | **1·414** | **1·057** | **28·5** | **3·08** | **8·67** | Ratio, A.M. : P.M. { Yield, 1·30 : 1.<br>Fat, %, 1 : 1·51. |
| III. | Aug. 2–Aug. 6 | 14·5 | 11·4 | 2·51 | 4·02 | 8·46 | 8·20 | 0·364 | 0·460 | 1·227 | 0·933 | 25·9 | 3·18 | 8·34 | Received daily—<br>2 lb. undec. cotton-cake } *all at morn-*<br>3 " maize-meal } *ing milking.*<br>At pasture day and night. |
| | " 7– " 13 | 13·8 | 8·8 | 2·67 | 3·98 | 8·14 | 8·15 | 0·371 | 0·349 | 1·122 | 0·711 | 22·6 | 3·19 | 8·14 | |
| | " 14– " 20 | 13·4 | 9·6 | 2·48 | 3·74 | 8·25 | 8·31 | 0·336 | 0·357 | 1·108 | 0·795 | 23·0 | 3·01 | 8·27 | |
| | **Mean results for third period** | **13·8** | **9·8** | **2·55** | **3·88** | **8·25** | **8·24** | **0·355** | **0·382** | **1·136** | **0·809** | **23·6** | **3·12** | **8·25** | Ratio, A.M. : P.M. { Yield, 1·41 : 1.<br>Fat, %, 1 : 1·52. |
| IV. | Aug. 21–Aug. 25 | 12·8 | 8·4 | 2·67 | 3·94 | 8·14 | 8·17 | 0·342 | 0·331 | 1·042 | 0·686 | 21·2 | 3·17 | 8·15 | Stall food as in Period I.<br>At pasture day and night. |
| | " 26–Sept. 1 | 11·8 | 8·9 | 2·70 | 3·98 | 8·07 | 7·86 | 0·319 | 0·354 | 0·949 | 0·703 | 20·7 | 3·25 | 7·98 | |
| | Sept. 2– " 9 | 10·6 | 5·8 | 2·64 | 3·67 | 7·58 | 7·04 | 0·275 | 0·222 | 0·800 | 0·415 | 16·4 | 3·03 | 7·41 | |
| | **Mean results for fourth period** | **11·5** | **7·5** | **2·66** | **3·84** | **7·90** | **7·66** | **0·307** | **0·292** | **0·911** | **0·578** | **19·0** | **3·15** | **7·84** | Ratio, A.M. : P.M. { Yield, 1·53 : 1.<br>Fat, %, 1 : 1·44. |

# TABLE XIX.—COW No. 14. (Control Group.) Age, 6 years.

Period of Lactation (to June 7), 4 weeks. Weight on July 4, 12 cwt. 2 qr 2 lb. ; Aug. 2, 12 cwt. 2 qr. 6 lb. : Sept 12, 12 cwt. 1 qr. 22 lb.

## MEAN DAILY RESULTS.

| Period. | | Milk yield. | | Fat. | | Solids-not-fat. | | Total weight of fat | | Total weight of solids-not-fat. | | Mixed morning and evening milk. | | | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S N F | |
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 26·8 | 20·8 | 2·78 | 4·50 | 8·84 | 8·71 | 0·751 | 0·941 | 2·379 | 1·812 | 47·6 | 3·56 | 8·80 | Received daily—<br>2 lb. undec. cotton-cake } given morn.<br>3 " maize-meal } and night.<br>At pasture day and night. |
| | " 14– " 20 | 26·4 | 20·3 | 2·28 | 3·95 | 8·89 | 8·86 | 0·601 | 0·800 | 2·344 | 1·797 | 46·7 | 3·00 | 8·87 | |
| | " 21– " 27 | 24·9 | 18·9 | 2·67 | 4·14 | 8·89 | 8·88 | 0·666 | 0·782 | 2·216 | 1·678 | 43·8 | 3·31 | 8·89 | |
| | " 28–July 4 | 24·0 | 17·2 | 2·88 | 4·02 | 8·93 | 8·85 | 0·691 | 0·698 | 2·144 | 1·533 | 41·2 | 3·37 | 8·92 | |
| **Mean results for first period** | | **25·5** | **19·3** | **2·64** | **4·13** | **8·89** | **8·83** | **0·671** | **0·800** | **2·264** | **1·704** | **44·8** | **3·28** | **8·86** | Ratio, A.M. : P.M. { Yield, 1·32 : 1.<br>Fat, %, 1 : 1·56. |
| II. | July 5–July 11 | 22·2 | 17·6 | 2·58 | 4·10 | 9·02 | 8·82 | 0·576 | 0·720 | 2·006 | 1·549 | 39·8 | 3·26 | 8·93 | Stall food as in Period I.<br>At pasture day and night. |
| | " 12– " 18 | 21·0 | 15·9 | 2·64 | 4·36 | 8·90 | 8·76 | 0·556 | 0·692 | 1·870 | 1·389 | 36·9 | 3·38 | 8·83 | |
| | " 19– " 25 | 21·0 | 15·3 | 2·57 | 4·24 | 8·92 | 8·78 | 0·540 | 0·649 | 1·874 | 1·343 | 36·3 | 3·28 | 8·86 | |
| | " 26–Aug. 1 | 20·6 | 15·3 | 2·70 | 4·53 | 8·79 | 8·59 | 0·556 | 0·694 | 1·810 | 1·314 | 35·9 | 3·44 | 8·61 | |
| **Mean results for second period** | | **21·2** | **16·0** | **2·62** | **4·31** | **8·91** | **8·74** | **0·557** | **0·689** | **1·889** | **1·399** | **37·2** | **3·35** | **8·84** | Ratio, A.M. : P.M. { Yield, 1·33 : 1.<br>Fat, %, 1 : 1·64. |
| III. | Aug. 2–Aug. 6 | 19·7 | 15·6 | 2·78 | 4·27 | 8·77 | 8·66 | 0·546 | 0·666 | 1·728 | 1·351 | 35·3 | 3·43 | 8·72 | Stall food as in Period I.<br>At pasture day and night. |
| | " 7– " 13 | 20·9 | 14·1 | 2·75 | 4·36 | 8·79 | 8·69 | 0·575 | 0·616 | 1·839 | 1·229 | 35·0 | 3·40 | 8·77 | |
| | " 14– " 20 | 20·2 | 13·2 | 2·82 | 4·19 | 8·75 | 8·80 | 0·568 | 0·549 | 1·763 | 1·157 | 33·3 | 3·36 | 8·77 | |
| **Mean results for third period** | | **20·3** | **14·0** | **2·79** | **4·26** | **8·77** | **8·74** | **0·566** | **0·597** | **1·779** | **1·224** | **34·3** | **3·39** | **8·76** | Ratio, A.M. : P.M. { Yield, 1·45 : 1.<br>Fat, %, 1 : 1·53. |
| IV. | Aug. 21–Aug 25 | 17·4 | 13·6 | 3·20 | 4·48 | 9·03 | 8·53 | 0·554 | 0·613 | 1·568 | 1·162 | 31·0 | 3·76 | 8·81 | Stall food as in Period I.<br>Also at evening milking hay *ad lib.* for the night.<br>At pasture *day only.* |
| | " 26–Sept 1 | 17·9 | 13·6 | 3·11 | 4·38 | 8·91 | 8·46 | 0·557 | 0·595 | 1·596 | 1·149 | 31·5 | 3·66 | 8·71 | |
| | Sept 2– " 9 | 17·3 | 12·7 | 3·09 | 4·51 | 8·91 | 8·44 | 0·537 | 0·573 | 1·541 | 1·072 | 30·0 | 3·70 | 8·71 | |
| **Mean results for fourth period** | | **17·5** | **13·2** | **3·12** | **4·46** | **8·94** | **8·48** | **0·548** | **0·589** | **1·565** | **1·118** | **30·7** | **3·70** | **8·74** | Ratio, A.M. : P.M. { Yield, 1·33 : 1.<br>Fat, %, 1 : 1·43. |

## TABLE XX.—COW No. 15. (TEST GROUP.) AGE, 6 years.

PERIOD OF LACTATION (to June 7), 11 weeks WEIGHT on July 4, 10 cwt. 3 qr. 20 lb ; Aug. 2, 10 cwt. 3 qr. 18 lb. , Sept. 12, 11 cwt. 0 qr. 10 lb.

MEAN DAILY RESULTS.

| PERIOD | | Milk yield | | Fat | | Solids not-fat | | Total weight of fat | | Total weight of solids not fat | | Mixed morning and evening milk | | | FOOD, ETC. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A M | P M | A M | P M | A M | P M | A M | P M | A M | P M | Yield | Fat | S-N F | |
| | | lb | lb | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7 June 13 | 23·6 | 16·1 | 2·41 | 3·75 | 8·75 | 8·79 | 0·570 | 0·705 | 2·063 | 1·415 | 39·7 | 3·21 | 8·76 | Received daily—<br>2 lb. undec. cotton-cake } given morn.<br>3 " maize-meal } and night.<br>At pasture day and night. |
| | " 14– " 20 | 21·7 | 16·0 | 2·32 | 3·51 | 8·88 | 8·92 | 0·503 | 0·564 | 1·928 | 1·427 | 37·7 | 2·33 | 8·90 | |
| | " 21– " 27 | 20·6 | 14·9 | 2·54 | 3·77 | 8·89 | 8·66 | 0·526 | 0·560 | 1·836 | 1·285 | 35·5 | 3·06 | 8·79 | |
| | " 28–July 4 | 18·9 | 13·7 | 2·49 | 3·49 | 8·82 | 8·92 | 0·470 | 0·480 | 1·665 | 1·223 | 32·6 | 2·92 | 8·86 | |
| Mean results for first period | | **21·1** | **15·2** | **2·44** | **3·62** | **8·84** | **8·83** | **0·515** | **0·573** | **1·866** | **1·339** | **36·3** | **3·00** | **8·83** | RATIO, A M. P.M. { Yield, 1·39 . 1.<br>Fat, %, 1 : 1·48. |
| II. | July 5–July 11 | 19·1 | 13·7 | 2·45 | 3·66 | 9·06 | 8·91 | 0·469 | 0·503 | 1·735 | 1·223 | 32·9 | 2·96 | 8·99 | Received daily—<br>2 lb undec. cotton-cake } all at *morn-*<br>3 " decort. " " } *ing* milking.<br>At pasture day and night. |
| | " 12– " 18 | 17·9 | 12·7 | 2·42 | 3·59 | 9·00 | 8·75 | 0·433 | 0·459 | 1·606 | 1·116 | 30·6 | 2·91 | 8·89 | |
| | " 19– " 25 | 17·6 | 11·9 | 2·50 | 3·66 | 8·95 | 8·79 | 0·442 | 0·435 | 1·580 | 1·042 | 29·5 | 2·97 | 8·89 | |
| | " 26–Aug 1 | 16·3 | 11·9 | 2·45 | 3·90 | 8·80 | 8·54 | 0·399 | 0·466 | 1·431 | 1·018 | 28·2 | 3·07 | 8·69 | |
| Mean results for second period | | **17·8** | **12·6** | **2·45** | **3·70** | **8·95** | **8·76** | **0·437** | **0·466** | **1·594** | **1·103** | **30·3** | **2·98** | **8·90** | RATIO, A M. P.M. { Yield, 1·41 : 1.<br>Fat, %, 1 : 1·50. |
| III. | Aug. 2–Aug. 6 | 15·8 | 11·9 | 2·59 | 3·62 | 8·80 | 8·62 | 0·410 | 0·430 | 1·390 | 1·027 | 27·7 | 3·03 | 8·72 | Received daily—<br>2 lb. undec. cotton-cake } *all at morn-*<br>3 " maize-meal } *ing milking.*<br>At pasture day and night. |
| | " 7– " 13 | 16·4 | 10·5 | 2·67 | 3·95 | 8·90 | 8·70 | 0·437 | 0·416 | 1·455 | 0·913 | 26·9 | 3·17 | 8·80 | |
| | " 14– " 20 | 14·7 | 9·9 | 2·69 | 3·90 | 8·82 | 8·89 | 0·396 | 0·389 | 1·297 | 0·883 | 24·6 | 3·19 | 8·86 | |
| Mean results for third period | | **15·6** | **10·6** | **2·65** | **3·84** | **8·84** | **8·76** | **0·414** | **0·410** | **1·380** | **0·932** | **26·3** | **3·13** | **8·79** | RATIO, A.M. : P.M { Yield, 1·47 · 1.<br>Fat, %, 1 . 1·45. |
| IV. | Aug. 21–Aug. 25 | 14·2 | 9·6 | 2·91 | 3·87 | 8·87 | 8·67 | 0·414 | 0·372 | 1·260 | 0·833 | 23·8 | 3·30 | 8·79 | Stall food as in Period I.<br>At pasture day and night. |
| | " 26–Sept. 1 | 14·0 | 8·8 | 2·76 | 4·36 | 8·67 | 8·49 | 0·387 | 0·383 | 1·213 | 0·746 | 22·8 | 3·38 | 8·59 | |
| | Sept. 2– " 9 | 13·0 | 7·8 | 3·13 | 3·86 | 8·53 | 8·35 | 0·405 | 0·306 | 1·108 | 0·654 | 20·8 | 3·42 | 8·47 | |
| Mean results for fourth period | | **13·7** | **8·7** | **2·94** | **4·07** | **8·68** | **8·52** | **0·400** | **0·354** | **1·187** | **0·739** | **22·4** | **3·37** | **8·60** | RATIO, A.M. . P.M. { Yield, 1·57 : 1.<br>Fat, %, 1 : 1·38. |

## TABLE XXI.—COW No. 16. (Test Group.) Age, 5 years.

**Period of Lactation** (to June 7), 9 weeks. **Weight** on July 4, 10 cwt. 0 qr. 8 lb.; Aug. 2, 10 cwt. 0 qr 0 lb.; Sept. 12, 9 cwt. 3 qr. 0 lb.

MEAN DAILY RESULTS.

| Period. | Milk yield. | | Fat. | | Solids-not-fat. | | Total weight of fat | | Total weight of solids not-fat | | Mixed morning and evening milk | | | Food, Etc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | A.M. | P.M. | Yield | Fat | S-N F | |
| | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. June 7–June 13 | 20·2 | 15·0 | 3·34 | 4·27 | 9·56 | 9·62 | 0·675 | 0·642 | 1·932 | 1·444 | 35·2 | 3·74 | 9·59 | Received daily— |
| I. " 14– " 20 | 19·0 | 14·3 | 3·41 | 4·60 | 9·41 | 9·38 | 0·649 | 0·659 | 1·788 | 1·340 | 33·3 | 3·93 | 9·39 | 2 lb. undec. cotton-cake } given morn. |
| I. " 21– " 27 | 18·6 | 14·2 | 3·20 | 4·60 | 9·31 | 9·33 | 0·593 | 0·652 | 1·740 | 1·326 | 32·8 | 3·80 | 9·35 | 3 " maize-meal } and night. |
| I. " 28–July 4 | 18·3 | 13·4 | 3·34 | 4·35 | 9·36 | 9·39 | 0·610 | 0·580 | 1·712 | 1·254 | 31·6 | 3·76 | 9·38 | At pasture day and night. |
| **Mean results for first period** | **19·0** | **14·2** | **3·32** | **4·45** | **9·41** | **9·43** | **0·632** | **0·633** | **1·793** | **1·341** | **33·2** | **3·81** | **9·44** | Ratio, A.M. : P.M. { Yield, 1·34 : 1. Fat, %, 1 : 1·34. |
| II. July 5–July 11 | 17·7 | 12·7 | 3·17 | 4·47 | 9·34 | 9·27 | 0·561 | 0·569 | 1·656 | 1·179 | 30·4 | 3·72 | 9·33 | Received daily— |
| II. " 12– " 18 | 16·9 | 11·9 | 3·08 | 4·56 | 9·37 | 9·29 | 0·515 | 0·542 | 1·574 | 1·109 | 23·8 | 3·67 | 9·32 | 2 lb. undec. cotton-cake } all at *morning* milking. |
| II. " 19– " 25 | 15·8 | 10·8 | 2·96 | 4·74 | 9·34 | 9·33 | 0·467 | 0·512 | 1·476 | 1·007 | 26·6 | 3·68 | 9·33 | 3 " decort. " " |
| II. " 26–Aug. 1 | 14·4 | 10·7 | 3·01 | 5·01 | 9·33 | 9·18 | 0·435 | 0·536 | 1·346 | 0·983 | 25·1 | 3·87 | 9·28 | At pasture day and night. |
| **Mean results for second period** | **16·2** | **11·5** | **3·05** | **4·70** | **9·35** | **9·26** | **0·495** | **0·540** | **1·513** | **1·069** | **27·7** | **3·74** | **9·32** | Ratio, A.M. : P.M. { Yield, 1·41 : 1. Fat, %, 1 1·54. |
| III. Aug. 2–Aug 6 | 13·8 | 10·3 | 3·30 | 4·75 | 9·41 | 9·24 | 0·456 | 0·490 | 1·299 | 0·952 | 24·1 | 3·93 | 9·34 | Received daily— |
| III. " 7– " 13 | 15·9 | 10·0 | 3·29 | 4·66 | 9·20 | 9·20 | 0·521 | 0·466 | 1·459 | 0·919 | 25·9 | 3·81 | 9·20 | 2 lb undec. cotton cake } *all at morning milking.* 3 " maize-meal |
| III. " 14– " 20 | 14·9 | 9·5 | 3·36 | 4·95 | 9·13 | 9·39 | 0·501 | 0·472 | 1·363 | 0·892 | 24·4 | 3·99 | 9·24 | At pasture day and night. |
| **Mean results for third period** | **15·0** | **9·9** | **3·32** | **4·79** | **9·21** | **9·28** | **0·497** | **0·475** | **1·397** | **0·918** | **24·9** | **3·90** | **9·26** | Ratio, A.M. : P.M. { Yield, 1·51 : 1. Fat, %, 1 : 1·44. |
| IV. Aug. 21–Aug 25 | 14·0 | 10·1 | 3·42 | 5·31 | 9·28 | 9·39 | 0·478 | 0·536 | 1·298 | 0·948 | 24·1 | 4·21 | 9·32 | Stall food as in Period I. |
| IV. " 26–Sept. 1 | 13·3 | 9·7 | 3·80 | 5·18 | 9·26 | 9·25 | 0·504 | 0·499 | 1·227 | 0·894 | 23·0 | 4·36 | 9·26 | At pasture day and night. |
| IV. Sept. 2– " 9 | 12·0 | 8·2 | 3·95 | 5·33 | 9·27 | 9·17 | 0·473 | 0·436 | 1·106 | 0·750 | 20·1 | 4·52 | 9·24 | |
| **Mean results for fourth period** | **12·9** | **9·2** | **3·77** | **5·28** | **9·27** | **9·27** | **0·484** | **0·482** | **1·195** | **0·847** | **22·1** | **4·37** | **9·27** | Ratio, A.M. : P.M. { Yield, 1·40 : 1. Fat, %, 1 : 1·40. |

## TABLE XXII.—COW No. 17. (CONTROL GROUP.) AGE, 7 years.

PERIOD OF LACTATION (to June 7), 9 weeks. WEIGHT on July 4, 10 cwt. 3 qr. 16 lb.; Aug 2, 10 cwt. 3 qr. 6 lb., Sept. 12, 11 cwt. 0 qr. 8 lb.

### MEAN DAILY RESULTS

| Period | Milk yield A.M. | Milk yield P.M. | Fat A.M. | Fat P.M. | Solids-not-fat A.M. | Solids-not-fat P.M. | Total weight of fat A.M. | Total weight of fat P.M. | Total weight of solids-not fat A.M. | Total weight of solids-not fat P.M. | Mixed morning and evening milk Yield | Mixed morning and evening milk Fat | Mixed morning and evening milk S-N F | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. June 7–June 13 | 22·8 | 15·1 | 2·13 | 3·54 | 9·28 | 9·32 | 0·486 | 0·535 | 2·114 | 1·411 | 37·9 | 2·70 | 9·30 | Received daily— 2 lb. undec. cotton-cake, 3 " maize-meal, given morn. and night. At pasture day and night |
| " 14 " 20 | 21·1 | 14·6 | 2·08 | 3·65 | 9·03 | 9·03 | 0·439 | 0·533 | 1·908 | 1·315 | 35·7 | 2·72 | 9·03 | |
| " 21– " 27 | 20·9 | 13·9 | 2·06 | 3·25 | 8·97 | 8·98 | 0·430 | 0·450 | 1·871 | 1·245 | 34·8 | 2·53 | 8·97 | |
| " 28–July 4 | 20·1 | 12·9 | 2·19 | 3·18 | 8·91 | 8·96 | 0·441 | 0·415 | 1·795 | 1·159 | 33·0 | 2·60 | 8·94 | |
| **Mean results for first period** | **21·2** | **14·1** | **2·11** | **3·41** | **9·05** | **9·06** | **0·449** | **0·483** | **1·922** | **1·283** | **35·4** | **2·63** | **9·05** | RATIO, A.M. : P.M. Yield, 1·50 : 1. Fat, %, 1 : 1·62 |
| II. July 5–July 11 | 19·4 | 13·1 | 2·06 | 3·47 | 8·92 | 8·81 | 0·397 | 0·456 | 1·725 | 1·151 | 32·5 | 2·63 | 8·86 | Stall food as in Period I. At pasture day and night. |
| " 12– " 18 | 17·7 | 11·0 | 2·17 | 3·65 | 8·92 | 8·62 | 0·383 | 0·401 | 1·579 | 0·949 | 28·7 | 2·73 | 8·82 | |
| " 19– " 25 | 17·1 | 11·2 | 2·19 | 3·62 | 8·76 | 8·59 | 0·375 | 0·408 | 1·502 | 0·966 | 28·3 | 2·77 | 8·72 | |
| " 26–Aug. 1 | 17·3 | 10·9 | 2·46 | 3·48 | 8·92 | 8·82 | 0·424 | 0·378 | 1·538 | 0·958 | 28·2 | 2·85 | 8·85 | |
| **Mean results for second period** | **17·9** | **11·6** | **2·21** | **3·55** | **8·88** | **8·72** | **0·394** | **0·411** | **1·588** | **1·010** | **29·5** | **2·73** | **8·81** | RATIO, A.M. : P.M. Yield, 1·54 : 1. Fat, %, 1 : 1·60 |
| III. Aug. 2–Aug. 6 | 15·9 | 10·9 | 2·66 | 3·51 | 8·95 | 8·70 | 0·420 | 0·382 | 1·421 | 0·946 | 26·8 | 3·00 | 8·83 | Stall food as in Period I. At pasture day and night. |
| " 7– " 13 | 15·4 | 9·2 | 2·55 | 3·59 | 8·98 | 8·79 | 0·393 | 0·329 | 1·383 | 0·806 | 24·6 | 2·94 | 8·90 | |
| " 14– " 20 | 14·9 | 9·1 | 2·44 | 3·48 | 8·85 | 8·82 | 0·364 | 0·332 | 1·322 | 0·805 | 24·1 | 2·89 | 8·83 | |
| **Mean results for third period** | **15·3** | **9·6** | **2·53** | **3·53** | **8·92** | **8·78** | **0·387** | **0·343** | **1·367** | **0·839** | **24·9** | **2·93** | **8·86** | RATIO, A.M. : P.M. Yield, 1·59 : 1. Fat, %, 1 : 1·40. |
| IV Aug. 21–Aug. 25 | 14·4 | 8·7 | 2·54 | 3·64 | 8·99 | 8·92 | 0·366 | 0·317 | 1·294 | 0·776 | 23·1 | 2·96 | 8·96 | Stall food as in Period I. At pasture day and night |
| " 26–Sept. 1 | 13·7 | 8·1 | 2·62 | 3·74 | 9·16 | 8·93 | 0·360 | 0·301 | 1·256 | 0·722 | 21·8 | 3·03 | 9·07 | |
| Sept. 2– " 9 | 11·4 | 7·0 | 2·77 | 4·09 | 8·96 | 8·76 | 0·314 | 0·285 | 1·019 | 0·608 | 18·3 | 3·27 | 8·90 | |
| **Mean results for fourth period** | **13·0** | **7·8** | **2·66** | **3·85** | **9·04** | **8·87** | **0·343** | **0·298** | **1·170** | **0·689** | **20·7** | **3·10** | **8·99** | RATIO, A.M. : P.M. Yield, 1·67 : 1. Fat, %, 1 : 1·45. |

## TABLE XXIII. COW No. 19. (Test Group.) Age, 6 years.

Period of Lactation (to June 7), 8 weeks. Weight on July 4, 10 cwt. 0 qr. 16 lb.; Aug. 2, 10 cwt. 0 qr. 12 lb : Sept. 12, 10 cwt. 0 qr. 16 lb.

MEAN DAILY RESULTS.

| Period. | Milk yield A.M. | Milk yield P.M. | Fat A.M. | Fat P.M. | Solids-not-fat A.M. | Solids-not-fat P.M. | Total weight of fat A.M. | Total weight of fat P.M. | Total weight of solids-not-fat A.M. | Total weight of solids-not-fat P.M. | Mixed morning and evening milk Yield | Mixed morning and evening milk Fat | Mixed morning and evening milk S-N F | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb | lb. | % | % | % | % | lb | lb | lb. | lb. | lb | % | % | |
| I. June 7–June 13 | 24·4 | 19·4 | 2·67 | 4·11 | 8·97 | 8·99 | 0·650 | 0·796 | 2·186 | 1·740 | 43·7 | 3·31 | 8·98 | Received daily— |
| " 14– " 20 | 23·4 | 18·0 | 2·54 | 4·00 | 8·93 | 9·19 | 0·595 | 0·722 | 2·086 | 1·653 | 41·4 | 3·18 | 9·03 | 2 lb undec. cotton-cake } given morn. |
| " 21– " 27 | 22·4 | 17·3 | 2·70 | 4·13 | 8·90 | 9·05 | 0·605 | 0·713 | 1·995 | 1·564 | 39·7 | 3·32 | 8·97 | 3 " maize-meal } and night. |
| " 28–July 4 | 20·8 | 15·7 | 2·95 | 3·98 | 9·04 | 9·17 | 0·613 | 0·623 | 1·884 | 1·435 | 36·4 | 3·40 | 9·12 | At pasture day and night. |
| Mean results for first period | **22·7** | **17·6** | **2·71** | **4·05** | **8·96** | **9·10** | **0·616** | **0·714** | **2·038** | **1·598** | **40·3** | **3·30** | **9·02** | Ratio, A.M. : P.M. { Yield, 1·29 : 1; Fat, %, 1 : 1·49. |
| II. July 5–July 11 | 20·0 | 15·9 | 2·80 | 4·05 | 9·08 | 9·09 | 0·561 | 0·644 | 1·816 | 1·442 | 35·9 | 3·36 | 9·08 | Received daily— |
| " 12– " 18 | 19·9 | 13·9 | 2·99 | 4·04 | 9·00 | 8·81 | 0·595 | 0·562 | 1·786 | 1·222 | 33·7 | 3·43 | 8·93 | 2 lb. undec. cotton-cake } all at *morn-* |
| " 19– " 25 | 18·4 | 13·5 | 3·13 | 4·38 | 8·97 | 8·71 | 0·576 | 0·591 | 1·650 | 1·176 | 31·9 | 3·66 | 8·87 | 3 " decort. " " } *ing* milking. |
| " 26–Aug. 1 | 18·8 | 13·4 | 2·92 | 4·11 | 8·94 | 8·84 | 0·550 | 0·553 | 1·679 | 1·187 | 32·2 | 3·43 | 8·90 | At pasture day and night. |
| Mean results for second period | **19·3** | **14·2** | **2·95** | **4·14** | **9·00** | **8·86** | **0·570** | **0·587** | **1·739** | **1·260** | **33·5** | **3·46** | **8·95** | Ratio, A.M. : P.M. { Yield, 1·36 : 1.; Fat, %, 1 : 1·40. |
| III. Aug. 2–Aug 6 | 17·4 | 13·0 | 2·67 | 4·05 | 8·90 | 8·72 | 0·465 | 0·526 | 1·549 | 1·133 | 30·4 | 3·26 | 8·82 | Received daily— |
| " 7– " 13 | 18·0 | 11·8 | 3·18 | 4·24 | 8·88 | 8·75 | 0·573 | 0·500 | 1·599 | 1·032 | 29·8 | 3·60 | 8·83 | 2 lb. undec. cotton-cake } *all at morn-* |
| " 14– " 20 | 17·4 | 11·8 | 3·03 | 4·26 | 8·86 | 8·92 | 0·526 | 0·502 | 1·538 | 1·051 | 29·2 | 3·52 | 8·88 | 3 " maize-meal } *ing milking*; At pasture day and night. |
| Mean results for third period | **17·6** | **12·1** | **2·99** | **4·19** | **8·88** | **8·80** | **0·527** | **0·508** | **1·563** | **1·065** | **29·7** | **3·49** | **8·85** | Ratio, A.M. : P.M. { Yield, 1·45 : 1.; Fat, %, 1 : 1·40. |
| IV. Aug. 21–Aug. 25 | 16·6 | 11·6 | 3·10 | 4·16 | 8·93 | 8·91 | 0·514 | 0·481 | 1·483 | 1·034 | 28·2 | 3·53 | 8·93 | Stall food as in Period I. |
| " 26–Sept. 1 | 15·9 | 10·6 | 3·25 | 4·26 | 8·77 | 8·69 | 0·516 | 0·450 | 1·391 | 0·919 | 26·4 | 3·66 | 8·75 | At pasture day and night. |
| Sept. 2– " 9 | 14·8 | 9·7 | 3·30 | 4·58 | 8·73 | 8·66 | 0·487 | 0·444 | 1·287 | 0·839 | 24·4 | 3·82 | 8·71 | |
| Mean results for fourth period | **15·6** | **10·5** | **3·23** | **4·36** | **8·80** | **8·75** | **0·504** | **0·455** | **1·373** | **0·916** | **26·1** | **3·67** | **8·77** | Ratio, A.M. : P.M. { Yield, 1·49 : 1.; Fat, %, 1 : 1·35. |

## TABLE XXIV.—COW No. 23. (TEST GROUP.) AGE, 6 years.

PERIOD OF LACTATION (to June 7), 9 weeks. WEIGHT on July 4, 11 cwt 1 qr. 0 lb, Aug 2, 11 cwt 0 qr. 12 lb., Sept. 12, 10 cwt. 3 qr. 16 lb.

MEAN DAILY RESULTS.

| Period. | | Milk yield A.M. | Milk yield P.M. | Fat A.M. | Fat P.M. | Solids-not-fat A.M. | Solids-not-fat P.M. | Total weight of fat A.M. | Total weight of fat P.M. | Total weight of solids not fat A.M. | Total weight of solids not fat P.M. | Mixed morning and evening milk Yield | Mixed morning and evening milk Fat | Mixed morning and evening milk S.-N.-F. | Food, Etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | lb. | lb. | % | % | % | % | lb. | lb. | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 26·4 | 20·4 | 2·38 | 4·35 | 9·00 | 8·95 | 0·632 | 0·915 | 2·372 | 1·821 | 46·8 | 3·30 | 8·97 | Received daily— |
| | " 14– " 20 | 26·3 | 17·9 | 2·73 | 4·14 | 8·92 | 9·00 | 0·717 | 0·740 | 2·347 | 1·608 | 44·2 | 3·30 | 8·95 | 2 lb. undec. cotton-cake } given morn. |
| | " 21– " 27 | 24·6 | 18·1 | 2·37 | 4·35 | 8·88 | 8·88 | 0·584 | 0·786 | 2·181 | 1·611 | 42·7 | 3·21 | 8·88 | 3 " maize-meal } and night. |
| | " 28–July 4 | 24·1 | 17·3 | 2·60 | 4·43 | 8·93 | 8·86 | 0·628 | 0·770 | 2·158 | 1·528 | 41·4 | 3·38 | 8·90 | At pasture day and night. |
| Mean results for first period | | 25·3 | 18·5 | 2·50 | 4·33 | 8·93 | 8·92 | 0·634 | 0·809 | 2·258 | 1·649 | 43·8 | 3·32 | 8·92 | RATIO, A.M. P.M. { Yield, 1·37 : 1; Fat, %, 1 : 1·73 |
| II. | July 5–July 11 | 24·2 | 16·4 | 2·70 | 4·60 | 8·96 | 8·82 | 0·653 | 0·739 | 2·165 | 1·449 | 40·6 | 3·48 | 8·90 | Received daily— |
| | " 12– " 18 | 22·4 | 16·4 | 2·44 | 4·62 | 8·83 | 8·79 | 0·548 | 0·758 | 1·981 | 1·438 | 38·8 | 3·37 | 8·81 | 2 lb. undec. cotton-cake } all at *morn-* |
| | " 19– " 25 | 21·2 | 15·4 | 2·71 | 4·54 | 8·92 | 8·88 | 0·574 | 0·700 | 1·891 | 1·367 | 36·6 | 3·48 | 8·90 | 3 " decort. " " } *ing* milking. |
| | " 26–Aug 1 | 21·8 | 14·3 | 2·92 | 4·15 | 8·80 | 8·51 | 0·635 | 0·595 | 1·919 | 1·216 | 36·1 | 3·41 | 8·68 | At pasture day and night. |
| Mean results for second period | | 22·5 | 15·8 | 2·67 | 4·50 | 8·88 | 8·75 | 0·600 | 0·713 | 1·996 | 1·380 | 38·2 | 3·44 | 8·83 | RATIO, A.M. : P.M. { Yield, 1·42 : 1; Fat, %, 1 : 1·69. |
| III. | Aug. 2–Aug. 6 | 21·0 | 14·0 | 2·94 | 3·89 | 8·93 | 8·68 | 0·618 | 0·543 | 1·876 | 1·216 | 35·0 | 3·32 | 8·83 | Received daily— |
| | " 7– " 13 | 20·7 | 12·9 | 2·90 | 4·25 | 8·86 | 8·61 | 0·600 | 0·546 | 1·837 | 1·107 | 33·6 | 3·41 | 8·76 | 2 lb. undec. cotton-cake } *all at morn-* |
| | " 14– " 20 | 19·2 | 11·0 | 3·17 | 4·16 | 8·79 | 8·71 | 0·605 | 0·458 | 1·679 | 0·958 | 30·2 | 3·52 | 8·74 | 3 " maize-meal } *ing milking.* At pasture day and night. |
| Mean results for third period | | 20·1 | 12·3 | 3·03 | 4·12 | 8·85 | 8·67 | 0·606 | 0·505 | 1·774 | 1·064 | 32·3 | 3·44 | 8·78 | RATIO, A.M. P.M. { Yield, 1·63 : 1; Fat, %, 1 : 1·36. |
| IV. | Aug. 21–Aug. 25 | 16·3 | 11·0 | 3·48 | 4·59 | 8·76 | 8·63 | 0·569 | 0·505 | 1·430 | 0·949 | 27·3 | 3·94 | 8·71 | Stall food as in Period I. |
| | " 26–Sept 1 | 17·0 | 10·8 | 3·51 | 4·24 | 8·68 | 8·47 | 0·597 | 0·456 | 1·476 | 0·915 | 27·8 | 3·79 | 8·60 | Also at evening milking hay *ad lib.* for the night. |
| | Sept. 2– " 9 | 15·6 | 9·5 | 3·73 | 4·49 | 8·77 | 8·45 | 0·577 | 0·426 | 1·364 | 0·792 | 25·1 | 4·00 | 8·58 | At pasture *day only.* |
| Mean results for fourth period | | 16·2 | 10·2 | 3·60 | 4·43 | 8·73 | 8·50 | 0·582 | 0·452 | 1·415 | 0·864 | 26·4 | 3·92 | 8·63 | RATIO, A.M. P.M. { Yield, 1·59 : 1; Fat, %, 1 : 1·23. |

# TABLE XXV.—MIXED MILK OF THE EXPERIMENTAL HERD.

(Nos. 2, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 17, 19, 23.)

MEAN DAILY RESULTS.

| PERIOD. | | Milk yield | | Fat | | Solids-not-fat. | | Total *weight* of fat | | Total *weight* of solids-not-fat | | Mixed morning and evening milk. | | | FOOD, ETC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A M | P M | A M | P M | A M | P.M. | A M | P M | A.M | P M | Yield | Fat | S-N F | |
| | | lb. | lb. | % | % | % | % | lb. | lb | lb. | lb. | lb. | % | % | |
| I. | June 7–June 13 | 311·5 | 225·5 | 2 81 | 4 05 | 9 06 | 9 01 | 8 617 | 9 431 | 28 088 | 20 279 | 537·0 | 3·37 | 9·03 | |
| | " 14– " 20 | 298·5 | 217·5 | 2 78 | 4·06 | 8 96 | 9·03 | 8 061 | 8·846 | 26·708 | 19 567 | 516·0 | 3·28 | 8·99 | |
| | " 21– " 27 | 285 0 | 210·0 | 2·82 | 4 15 | 8·97 | 8·92 | 7 894 | 8·676 | 25·527 | 18·690 | 495·0 | 3 35 | 8·95 | |
| | " 28–July 4 | 274 5 | 196·5 | 2 89 | 3·92 | 9 00 | 8 95 | 7 840 | 7 717 | 24·713 | 17 573 | 471·0 | 3·31 | 8 99 | |
| **Mean results for first period** | | **291·6** | **211 8** | **2·81** | **4 05** | **8 99** | **8·97** | **8·072** | **8 630** | **26·195** | **18·965** | **503·4** | **3 32** | **8·98** | RATIO, A.M. : P M. {Yield, 1·38 : 1. Fat, %, 1 : 1·44. |
| II. | July 5–July 11 | 268 0 | 194 0 | 2·84 | 4·05 | 9 06 | 8 92 | 7·497 | 7 891 | 24 238 | 17 300 | 462 0 | 3 33 | 9·00 | |
| | " 12– " 18 | 252 5 | 179 5 | 2·82 | 4·14 | 8 96 | 8 83 | 7 011 | 7 470 | 22 584 | 15·860 | 432 0 | 3·35 | 8 90 | |
| | " 19– " 25 | 242 5 | 171·0 | 2·81 | 4 18 | 9 02 | 8·85 | 6 742 | 7 157 | 21 870 | 15 117 | 413·5 | 3 36 | 8·94 | |
| | " 26–Aug. 1 | 240·0 | 166·0 | 2 89 | 4·21 | 8 86 | 8 68 | 6·886 | 6 995 | 21 241 | 14·381 | 406 0 | 3 42 | 8 77 | |
| **Mean results for second period** | | **250 7** | **177·7** | **2·83** | **4·15** | **8·98** | **8 82** | **7·024** | **7·381** | **22 479** | **15 663** | **428 4** | **3 36** | **8 91** | RATIO, A.M. : P.M. {Yield, 1·41 : 1. Fat, %, 1 · 1·47. |
| III. | Aug. 2–Aug. 6 | 229 0 | 164·5 | 2 94 | 4·08 | 8·90 | 8 70 | 6 655 | 6·707 | 20 359 | 14 373 | 393 5 | 3 40 | 8·80 | |
| | " 7– " 13 | 232·5 | 148·5 | 3·08 | 4 19 | 8 83 | 8 73 | 7 103 | 6 250 | 20 492 | 12 952 | 381 0 | 3·51 | 8·79 | |
| | " 14– " 20 | 223 0 | 142·5 | 2 97 | 4 28 | 8 77 | 8 87 | 6 582 | 6 113 | 19 542 | 12 623 | 365·5 | 3 47 | 8·82 | |
| **Mean results for third period** | | **227·7** | **150 0** | **3 00** | **4 19** | **8 82** | **8 78** | **6 780** | **6 308** | **20·090** | **13 179** | **377 7** | **3 47** | **8·80** | RATIO. A M. · P.M. {Yield, 1 52 1. Fat, %, 1 : 1·40. |
| IV | Aug. 21–Aug. 25 | 205·0 | 137 5 | 3·17 | 4·27 | 8 84 | 8·74 | 6 438 | 5·866 | 18·074 | 12 006 | 342·5 | 3 60 | 8·79 | |
| | " 26–Sept. 1 | 195 0 | 133·0 | 3 23 | 4 39 | 8·77 | 8 60 | 6 273 | 5 848 | 17 106 | 11 419 | 328 0 | 3·69 | 8 69 | |
| | Sept 2– " 9 | 180 5 | 115·5 | 3 37 | 4 41 | 8·66 | 8·44 | 6 058 | 5 126 | 15 630 | 9 796 | 296 0 | 3·78 | 8·56 | |
| **Mean results for fourth period** | | **191·8** | **127·1** | **3 27** | **4 37** | **8 75** | **8 59** | **6 228** | **5 563** | **16 771** | **10 919** | **318 9** | **3·70** | **8 68** | RATIO, A.M. P M. {Yield, 1 51 : 1. Fat, %, 1 : 1·34. |

TABLE XXVI.—SHOWING TOTAL YIELD OF MILK, FAT, AND SOLIDS-NOT-FAT GIVEN BY EACH COW DURING THE WHOLE EXPERIMENT (95 DAYS).

| Cow No. | Total milk yield | Fat. | | Solids-not fat. | |
|---|---|---|---|---|---|
| | | Total weight | Per cent | Total weight | Per cent |
| | gallons * | lb | | lb | |
| 2 | 592·7 | 201·9 | 3·41 | 523·7 | 8·84 |
| 5 | 350·0 | 129·2 | 3·69 | 311·5 | 8·90 |
| 6 | 371·6 | 152·0 | 4·09 | 336·3 | 9·05 |
| 7 | 499·6 | 170·3 | 3·41 | 447·5 | 8·96 |
| 8 | 463·3 | 150·1 | 3·24 | 414·7 | 8·95 |
| 9 | 468·0 | 153·5 | 3·28 | 411·2 | 8·78 |
| 10 | 351·5 | 127·6 | 3·63 | 313·0 | 8·90 |
| 12 | 442·4 | 138·0 | 3·12 | 380·6 | 8·61 |
| 14 | 585·8 | 197·0 | 3·36 | 517·1 | 8·83 |
| 15 | 467·7 | 142·2 | 3·04 | 413·0 | 8·83 |
| 16 | 432·6 | 166·6 | 3·85 | 404·9 | 9·36 |
| 17 | 452·2 | 124·0 | 2·74 | 404·1 | 8·94 |
| 19 | 521·9 | 178·2 | 3·41 | 467·3 | 8·95 |
| 23 | 573·4 | 196·2 | 3·42 | 507·4 | 8·85 |
| Total for 14 cows (95 days) | 6573·5 | 2226·5 | 3·39 | 5850·8 | 8·90 |

* 10 lb. = 1 gallon

TABLE XXVII.—SHOWING FOR EACH COW THE MAXIMUM VARIATIONS IN YIELD AND QUALITY OF MILK IN ANY WEEK OF THE EXPERIMENT.

| Cow No. | Morning | | | | | | | | | Evening | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yield | | Week in which recorded | Fat | | Week in which recorded | Solids not fat | | Week in which recorded | Yield | | Week in which recorded | Fat | | Week in which recorded | Solids-not-fat | | Week in which recorded. |
| | Min. | Max | | Min | Max | | Min | Max | | Min | Max | | Min | Max | | Min | Max | |
| | lb | lb | | | % | | % | | | lb | lb | | % | | | % | % | |
| 2 | 16½ | 19½ | 14 | 2·25 | 3·15 | 2 | 8·69 | 9·20 | 5 | 13 | 16 | 8 | 3·50 | 4·70 | 9 | 8·40 | 9·11 | 7 |
| 5 | 10 | 13 | 11 | 2·85 | 3·67 | 9 | 8·70 | 9·39 | 7 | 7 | 10 | 11 | 3·82 | 4·80 | 9 | 8·76 | 9·33 | 1 |
| 6 | 9½ | 11½ | 14 | 2·92 | 4·00 | 5 | 8·86 | 9·46 | 1 | 6 | 8½ | 14 | 3·98 | 5·10 | 1 | 8·65 | 9·28 | 8 |
| 7 | 8½ | 15 | 13 | 1·80 | 4·10 | 9 | 8·80 | 9·47 | 4 | 7 | 13 | 13 | 1·82 | 7·53 | 13 | 8·53 | 9·32 | 7 |
| 8 | 19 | 23 | 3 | 1·75 | 3·70 | 3 | 8·68 | 9·52 | 5 | 11 | 15 | 5 | 2·70 | 5·60 | 6 | 9·00 | 9·66 | 1 |
| 9 | 11½ | 14 | 14 | 2·08 | 3·22 | 11 | 8·26 | 9·00 | 11 | 6 | 9½ | 14 | 2·84 | 6·70 | 10 | 7·82 | 8·72 | 14 |
| 10 | 9½ | 12 | 14 | 2·98 | 4·20 | 14 | 8·43 | 9·20 | 1 | 7½ | 11 | 1 | 2·68 | 5·00 | 11 | 8·52 | 9·21 | 7 |
| 12 | 7 | 13 | 14 | 1·92 | 3·48 | 10 | 6·85 | 8·14 | 14 | 3 | 8½ | 14 | 3·00 | 5·30 | 14 | 6·29 | 7·91 | 14 |
| 14 | 15 | 18½ | 14 | 2·44 | 3·53 | 11 | 8·63 | 9·36 | 11 | 11 | 14½ | 11 | 3·32 | 5·27 | 11 | 8·42 | 9·17 | 5 |
| 15 | 16½ | 19 | 6-7 | 2·18 | 4·30 | 14 | 8·40 | 9·25 | 4 | 14 | 19 | 2 | 3·10 | 5·17 | 3 | 8·35 | 9·25 | 6 |
| 16 | 13 | 16 | 8 | 2·62 | 3·82 | 10 | 9·01 | 9·57 | 3 | 8 | 11 | 13 | 4·25 | 6·12 | 14 | 8·94 | 9·55 | 6 |
| 17 | 9 | 13½ | 14 | 1·60 | 2·55 | 6 | 8·47 | 9·31 | 8 | 6 | 8 | 14 | 2·40 | 4·22 | 4 | 8·44 | 9·13 | 8 |
| 19 | 17½ | 20½ | 8 | 1·58 | 3·13 | 9 | 8·54 | 9·30 | 9 | 14 | 17 | 5 | 3·05 | 5·10 | 4 | 8·33 | 8·96 | 14 |
| 23 | 19 | 24 | 10 | 1·92 | 3·48 | 3 | 8·27 | 9·17 | 6 | 6½ | 12 | 14 | 3·42 | 5·65 | 7 | 8·48 | 9·54 | 1 |

LIMITS OF VARIATION (ALL SAMPLES)

| | Min. | | Max | |
|---|---|---|---|---|
| | % | | | |
| Fat . . . . | 1·58 | (No. 19, Aug. 6 A.M.) | 7·53 | (No. 7, Aug. 27, P.M.) |
| Solids-not fat . . | 6·29 | (No. 12, Sept 6, P.M.) | 9·86 | (No. 16, June 13, P.M.) |
| Total solids . . . . | 9·15 | (No. 12, Sept. 7, A.M.) | 16·00 | (No. 7, Aug. 27, P.M.) |
| Specific gravity (60° F.) . . | 1·0218 | (No. 12, Sept. 6 P.M.) | 1·0356 | (No. 16 {June 8, A.M.; " 12, A.M.; " 18, A.M.}) |

# THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1904, AND METEOROLOGY OF THE YEAR RELATIVE THERETO.

## THE CROPS.

THE following comparison of the cereal and other crops of 1904 with those of the previous year has been prepared by the Secretary of the Society from answers to queries sent to leading agriculturists in different parts of the country.

The meteorology of the year has been furnished by Dr Alex. Buchan, Secretary of the Meteorological Society of Scotland.

The queries issued by the Secretary were in the following terms:—

1. What was the quantity, per imperial acre, and quality of grain and straw, as compared with last year, of the following crops? The quantity of each crop to be stated in bushels. What quantity of seed is generally sown per acre?—(1) Wheat, (2) Barley, (3) Oats.
2. Did the harvest begin at the usual time, or did it begin before or after the usual time? and if so, how long?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards ryegrass and clover respectively? The quantity to be stated in tons and cwts.
4. Was the meadow-hay crop more or less productive than last year?
5. What was the yield of the potato crop, per imperial acre, as compared with last year? The quantity to be stated in tons and cwts. Was there any disease? and if so, to what extent, and when did it commence? Were any new varieties planted, and with what result?
6. What was the weight of the turnip crop, per imperial acre, and the quality, as compared with last year? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird? Was more than one sowing required? and why?
7. Were the crops injured by insects? State the kinds of insects. Was the damage greater or less than usual?
8. Were the crops injured by weeds? State the kinds of weeds. Was the damage greater or less than usual?
9. Were the pastures during the season of average growth and quality with last year?
10. How did stock thrive on them?

11. Have cattle and sheep been free from disease?
12. What was the quality of the clip of wool, and was it over or under the average?

From the answers received, the following notes and statistics have been compiled:—

EDINBURGHSHIRE. *Wheat.*—40 to 44 bushels; fine quality and well harvested. Straw about the same as last year. $3\frac{1}{2}$ bushels sown.

*Barley.*—40 to 48 bushels; quality superior to last year, and most of it used for malting. Straw heavier crop; 3 bushels seed sown.

*Oats.*—40 to 48 bushels; quality very good; fully heavier weight per bushel than last year; straw fine; 4 bushels seed sown.

*Harvest* commenced about the same time as last year, and finished in half the time In most cases about three weeks

*Hay* superior crop to last year, and well got; 2 tons 10 cwt. to 3 tons. Present prices 10s to 20s. less than last year. Second a fine crop, and all well got. *Meadow-hay*—Very little grown; light crop, and not so well got.

*Potatoes.*—About the same as last year; 7 to 10 tons. Very little disease. Poor prices, about the half of last year. Some new varieties were planted with very good results.

*Turnips.*—Very good crop; much the same as last year. Yellow 20 to 30 tons, swedes about 20 tons. Brairded well, and no second sowing. Not injured by fly. *Mangold*—A lighter crop than last year; 15 to 20 tons.

No damage by insects or weeds.

*Live Stock.*—Pastures were very good. Stock throve well and paid. Cattle and sheep quite free from disease. *Clip of wool*—Better than last year, and sold much dearer.

LINLITHGOWSHIRE. *Wheat.*—40 bushels; superior quality and yield, both grain and straw, compared to last year Seed sown, 4 bushels.

*Barley.*—40 to 48 bushels; fine quality, both grain and straw. Seed sown, 3 bushels.

*Oats.*—40 to 48 bushels; fine quality, both grain and straw. Seed sown, 4 bushels.

*Harvest* ten days before last year.

*Hay*—35 cwt; good quality, and an excellent second crop. Secured in fine condition; actually the best second cutting that has been got in this county for years past.

*Potatoes*—Fully better, about 8 tons; disease very rife in the older kinds. A few of the new varieties were planted with excellent results.

*Turnips.*—About 20 tons; brairded well, and did well all through. No second sowing

No injury by insects or by weeds.

*Live Stock.*—Pastures very good. Stock did well compared to last year, and were free from disease. *Clip of wool*—Average, with better prices.

HADDINGTON (Upper District.) *Wheat.*—None grown.

*Barley*—36 bushels; quality of grain and straw much better than last year. 3 bushels sown.

*Oats.*—40 bushels; quality of grain and straw very good. 4 bushels sown.

*Harvest* began at the usual time.

*Hay.*—2 tons, of very good quality. *Meadow-hay*—More productive than last year.

*Potatoes.*—6 to 7 tons; no disease. One new variety, "Langworthy, planted, and did very well.

• *Turnips.*—20 to 25 tons, of good quality; crop brairded well; only one sowing required.

No injury by insects or weeds.

*Live Stock* -Pastures were of average growth and quality with last year. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*— About an average.

HADDINGTONSHIRE (Lower District). *Wheat.*—40 to 48 bushels; rather better than last year, and a little more straw. Seed sown, 3½ to 4 bushels, broadcast; drill, 2½ to 3 bushels.

*Barley* —40 to 48 bushels, rather better than last year, and quality if anything finer; considerably more straw. Seed sown, 3½ to 4 bushels broadcast, and 2½ by drill.

*Oats.*—40 to 48 bushels; more than last year; more straw, and quality good. Seed sown, 4 to 5 bushels broadcast, and 3 to 3½ by drill.

*Harvest* began about the 23rd of August, or fully ten days earlier than last year. Weather very favourable, and crop secured in best of condition.

*Hay.*—About 2½ to 3 tons: fine quality; well secured. *Meadow-hay*— None grown.

*Potatoes.* "Up to-Dates" 8 to 10 tons; much the same as last year. "Maincrops" and "Langworthys" 7 to 8 tons; "Royal Kidneys" about 11 tons, and "Northern Stars" up to 17 tons. Very little disease, which appeared about September, amongst earlier kinds.

*Turnips* —20 to 30 tons; much heavier crop than last year. Good braird and no second sowing.

No damage from insects or weeds.

*Live Stock.*—Pastures were about an average in growth and quality. Stock did well Cattle and sheep both free from disease. *Clip of wool* —Quality and quantity about the average.

BERWICKSHIRE (Merse). *Wheat* —Straw good and bulky; grain 34 bushels. rather less than last year. Quality excellent. Wheat is now grown only in exceptionally favourable situations. Seed sown, 3½ bushels.

*Barley* —Grain of fair quality; hardly equal to the finest of last year, being smaller and thinner in the pickle, but much better than the average of last year. 38 to 50 bushels. Straw of the finest quality. Seed sown, 3 bushels.

*Oats* —Crop generally rather under last year's in bulk, but thrashing satisfactorily. Average, 38 bushels. Straw of the finest quality, though not so abundant as last year Seed sown, 4 bushels.

*Harvest* began about the same time as in the two previous years, which was about a week later than average The weather was exceptionally fine.

*Hay.*—Crop generally about one-third over previous year, but clover was deficient. Hay was got in fair condition—about 37 cwt. Aftermath generally poor. *Meadow-hay*—A good crop, about twice that of previous year. Not much meadow-hay cut in the Merse.

*Potatoes.*—A good crop; about 8 to 9 tons of good tubers; very little disease.

*Turnips.*—Crop about the same as last year—about 20 tons. Some very large crops are, however, reported Braird was good; sowing twice not required. Finger-and-toe very prevalent.

No insect pests worth mentioning. Weeds became very bad and difficult to kill in August owing to showery weather; chickweed unusually plentiful.

*Live Stock.*—Pastures were of good feeding quality during the season; grass very plentiful during autumn. Both sheep and cattle grazed well. Owing probably to the wet weather in August, scald and foot-rot have been unusually prevalent. *Clip of wool*—About one-sixth less weight than last year, except in the case of fed hoggs, when the weight would be about the same as former years.

BERWICKSHIRE (Lammermoor).—*Wheat*—Almost none grown.

*Barley.*—Grain of good quality, and generally fair colour, but thinner in the pickle than usual. About 36 bushels. Crop generally of fair bulk, but thrashing out rather disappointingly. Seed sown, 3 bushels. Barley is only grown in favourable situations.

*Oats.*—Crop a good average, and thrashing well. Grain of good quality when allowed to ripen. Straw of good bulk, and very fine quality. Yield, 36 bushels. Seed sown, 4½ to 5 bushels.

*Harvest* began about a week earlier than last year—about the second week of September—being about a week later than average. Splendid weather prevailed during the whole harvest.

*Hay.*—Crop fine quality, well got; clover deficient in quantity—about 36 cwt. Aftermath fairly good. *Meadow-hay*—A good crop, about twice the previous year's bulk. The only very showery weather of the season occurred during meadow-hay harvest, so that quality was much damaged.

*Potatoes.*—Crop over an average, but in some places an excess of small potatoes. No disease to speak of. About 8 tons lifted in very fine weather.

*Turnips.*—Crop about the same as last year. It looked very well early, but has hardly come up to expectations, roots being often small though of good quality. About 18 tons.

No insect pests worth mentioning. Weeds became very bad and difficult to kill in August owing to showery weather; chickweed unusually plentiful.

*Live Stock.*—During early part of the season pastures were good, but after the showery weather in August they got very rough and grass very plentiful. Both sheep and cattle grazed well. Lame sheep from scald and foot-rot have been very numerous. Rough wet pastures may have been the cause. *Clip of wool*—About one-sixth less weight than last year, except in the case of fed hoggs, when the weight would be about the same as former years.

ROXBURGHSHIRE. *Wheat.*—Very little grown; straw fairly good; grain fair. Seed sown, about 3½ bushels; yield, 20 to 30 bushels.

*Barley.* Quality better than last season, but wanted sun during the early part of the season; straw fairly good quality. Seed sown, about 3 bushels; yield from 20 to 30 bushels.

*Oats* mostly well ripened; hence grain fine quality and straw fine also. Seed sown, about 5 bushels, yield from 20 to 35 bushels.

*Harvest* earlier than usual, and most farms all cut and in the stack early in October.

*Hay.*—Fine quality and a fair yield. *Meadow-hay*—All got in fine order.

*Potatoes.*—A good average crop; practically no disease. "Up-to-Dates" and "Maincrops."

*Turnips.*—Large yield, and quality fine; crop brairded well; almost no resowing.

Almost no damage from insects. Small birds and rooks are becoming a great pest to farmers. Thistles very bad on a number of farms, and injuring crops very much.

*Live Stock.*—Pastures average quality. Stock did very well; almost no disease. *Clip of wool*—Good, and about an average.

SELKIRKSHIRE. *Wheat.*—Almost none grown.

*Barley.*—Only small acreage grown in this county; average 34 bushels; quality middling. Seed sown, 3½ bushels.

*Oats.*—Average 36 bushels; quality good; straw excellent. Seed sown, 5 bushels.

*Harvest* ten days late, but one of shortest on record.

*Hay.*—2 tons; fine quality and well got. *Meadow-hay*—A heavier crop than last year; not so well got. Average about 36 cwt.

*Potatoes.*—Average crop; fine quality.

*Turnips.*—20 tons; quality better than last year. No second sowing required.

No injury by insects or weeds.

*Live Stock.*—Pastures, growth very much above an average; usual quality. Stock generally did very well, but very much troubled with lameness, from which cause more injury has been sustained than for many years. *Clip of wool*—An average yield both in quantity and quality, but rather less weight than last year.

PEEBLESSHIRE. *Wheat.*—None grown.

*Barley.*—None grown.

*Oats.*—Quality good; about 32 bushels.

*Harvest* commenced about the usual time

*Hay.*—2 tons. *Meadow hay* good

*Potatoes.*—About 10 tons; little disease; no new varieties.

*Turnips.*—12 tons. No second sowing.

No injury by insects or weeds.

*Live Stock*—Pastures during the season of average growth and quality with last year Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—About an average.

DUMFRIESSHIRE (Annandale) *Wheat.*—No wheat grown in district.

*Barley.*—Not extensively grown. Gave good returns in straw and grain. The weather experienced during ripening being exceptionally good, the grain was well matured and of good colour, thereby all being fit for brewers; 38 bushels. Seed sown, 3½ to 4 bushels.

*Oats.*—Not so good as barley. The early spring being wet, land after roots (to be sown with this crop) was ploughed wet and sown wet. A cold spell of weather followed during the latter part of May, which checked the growth and thinned out the plants. The grass seeds sown along with the crop got the mastery and checked the oats, the resulting crop being in the majority of cases more than half grass. Lea oats suffered from grub, but was an average crop as regards bulk of straw. Harvest was late, and lea crops were cut green. Grain, though well up to last year in quantity, lacks quality; 31 bushels for oat crop Seed sown, 3 to 4 bushels of drilled, 4 to 5 broadcast, and in the case of new varieties, such as "Tartar King" and "Storm King," 6 to 7 when sown broadcast.

*Harvest* about ten days after the usual time.

*Hay.*—Ryegrass hay crop under last year as regards bulk, this being caused by scarcity of clover. Owing to an exceptionally mild winter, ryegrass plants were thick and strong. The wet spring gave this grass a good start. Clovers, however, were very disappointing, and very few fields with an average quantity were to be seen. This is a marked contrast to the preceding year, when clover formed the bulk of the crop. Weather during haymaking was excellent, and there is little or no damaged hay in the district. Weight of crop 1 ton 8 cwt. *Meadow-hay*—No marked difference in either weight or quality of crop from last year; 1 ton 12 cwt.

*Potatoes.*—This crop appeared to grow better than in 1903. Disease

began to show itself amongst the old varieties in September, otherwise the yield would have been much greater than in 1903. No new varieties planted; average yield about 6½ tons.

*Turnips.*—Weight of crop 18 tons. Will compare with last year. On light soils the crop is heavier, but on clayey soils disappointing, owing to land having to be wrought damp. Crop brairded well. Swedes on lighter soils were not quite sound, a good many roots being decayed at heart,—a sort of dry-rot.

Crops generally have been free from insect pests. Under this heading might be mentioned a disease affecting the mangel crop: it was noticed about the beginning of July. The leaves dropped down, and seemed to curl inward. The same thing was noticed in 1903, but was then supposed to be due to a touch of frost. This year, when it again appeared, there was no frost, and the plants were more particularly examined. Some farmers state that they noticed the presence of a small beetle, but the writer (after a careful examination) could not find any trace of insects, and thinks it is a parasite disease. The crop regained its usual appearance after a time, but as growth had been checked the roots did not attain their full size—were little more than half a crop. Crops were generally free from weeds. Oat crops after turnips in some places were damaged to some extent by "spurry."

*Live Stock.*—Pastures were of more than average growth and quality. Stock throve well. Store animals came to the autumn sales in extra good condition; better than in 1903. Cattle have been free from disease Foot-rot has been prevalent amongst sheep. *Clip of wool*—Quality good; better than last year, but under average in weight.

DUMFRIESSHIRE (Nithsdale). *Wheat*—None grown.

*Barley.*—Too little grown to be worth remark.

*Oats.*—With a fine genial summer, oats were a heavy crop—indeed in some places too much so—with a bulky straw. There was an unequal ripening, which made the grain not weigh so well to its bulk. About 40 bushels would be considered an average quantity. Quantity sown, 5 bushels; new varieties of oats 6 bushels. I do not think the latter will be extensively sown again

*Harvest* began about two weeks later than usual, and, with the uneven ripening of the crop between the low and high lands, dragged on for several weeks.

*Hay.*—This crop got a good start in spring, and continuing to grow, proved a bulky one, which was secured in excellent condition. It would be about 2 tons. *Meadow-hay*—Was more productive than last year, and where not cut too early was a big crop, got in first-class order.

*Potatoes.*—A much better crop than the year before, and in no case did I hear of a failure. There was no disease, and few small tubers. Quantity considerably above an average.

*Turnips.*—This crop never stopped growing from brairding to finish, and is a long way above the average. Unlike some seasons, when they are so big, they are quite sound and keeping well. Many fields will average from 25 to 30 tons.

All crops grew too quickly for insects to be able to do them any injury. The only complaint was to oats by wire-worm, which, particularly on heavy land, was destructive. No injury by weeds

*Live Stock.*—Pastures, both growth and quality, were above last year, and in no season in my remembrance was hill pasture so luxuriant. Where not too heavily stocked all animals throve quickly. Cattle and sheep free from disease. *Clip of wool*—About one fifth below previous year, and quality not so satisfactory. The price having risen makes up for the shortage.

DUMFRIESSHIRE (Eskdale). *Wheat.*—None grown in this district.

*Barley.*—None grown in this district.

*Oats.*—About 60 bushels. It was a better crop in quality of grain and straw last year, but was spoiled by bad weather. This year the quality was not so good, but it was very well got. Seed sown, 5 bushels.

*Harvest* began about the usual time.

*Hay.*—A heavier and better quality of crop than last year. *Meadow-hay*—More productive than last year.

*Potatoes.*—A long way better crop than last year. About one-third was diseased; the disease commenced about July.

*Turnips.*—About 10 tons. The crop brairded well. No more than one sowing required.

No damage by insects or weeds.

*Live Stock.*—Pastures far more than the average growth, and quality good. Stock throve very well. Cattle and sheep very free from disease. *Clip of wool*—Much about the same.

STEWARTRY OF KIRKCUDBRIGHT. *Wheat.*—32 bushels; quality better than last year. Seed sown, 2½ to 3 bushels.

*Barley.*—34 bushels; quality better than last year; straw less than last year. Seed sown, 3 to 4 bushels.

*Oats.*—35 bushels; quality of oats and straw better. Seed sown, 5 bushels.

*Harvest* began about the usual time, say 25th of August.

*Hay.*—Yield about 30 cwt.; quality extra good; yield much above average. *Meadow-hay*—Better than last year; 28 cwt.

*Potatoes.*—Better than last year, 7 tons. Some disease, say 10 per cent in some varieties, other kinds sound. "Evergoods," "Northern Stars," &c, in limited quantity; crop good.

*Turnips.*—18 to 22 tons, over average. Brairded well; almost no re-sowing.

No special injury by insects Charlock, as usual, prevailed in many fields; partly overcome by spraying

*Live Stock*—Pastures better in growth and quality. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—Quality average, but quantity less than average.

WIGTOWNSHIRE. *Wheat.*—29 bushels; quality of grain and straw better than last year owing to better weather in harvest; weight of straw 30 cwt. Seed sown, 2½ to 3½ bushels

*Barley.*—30 bushels; quality of grain and straw better than last year. Seed sown, 3½ to 4 bushels.

*Oats.*—32 bushels; quality of grain and straw much better than last year, but yield of straw light. Seed sown, 5 bushels.

*Harvest* about a week earlier.

*Hay.*—1 ton 15 cwt.; better yield than last year, and quality very good. *Meadow-hay*—Less productive, but quality much better than last year.

*Potatoes.*—About 5 tons; less disease, but more small tubers than last year. No new varieties planted.

*Turnips.*—20 tons; a much better crop than last year; quality good; crop brairded well; very little second sowing required.

No injury to crops by insects or weeds.

*Live Stock.*—Pastures during the season were of average growth and quality with last year. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—Quality good, but rather under average in weight.

AYRSHIRE. *Wheat.*—None grown.

*Barley.*—44 bushels; quality average. Seed sown, 3 to 3½ bushels.

*Oats.*—42 bushels; variable in quality. Seed sown, 4 to 6 bushels. Many plots had to be resown in spring in whole or in part (wire-worm).

*Harvest* ten days later than the average.

*Hay.*—Good crop; secured in fine condition; 1 ton 15 cwt. *Meadow-hay*—Fully an average.

*Potatoes.*—From 5 to 10 tons, according to time of raising; all grown for the early market. No disease. Several new early kinds planted.

*Turnips.*—22 to 25 tons. Much better crop than last year. Brairded well; little resowing.

The damage to the oat crop from grub and wire-worm has been much greater than usual during the last two seasons. Damage from annual weeds, principally chickweed, groundsel, and nettles, increases yearly.

*Live Stock.*—Pastures during the season of average growth and quality with last year, but late in spring. Stock throve generally well. Cattle and sheep free from disease. *Clip of wool*—Average.

BUTE. *Wheat.*—None grown.

*Barley.*—3½ bushels sown; crop well got; yield, 42 bushels; very fine sample; straw above average.

*Oats*—5 bushels sown; well got; 40 bushels straw; above average; grain very fine quality.

*Harvest* began at the usual time.

*Hay.*—A good average crop, very well got. About 2 tons. *Meadow-hay*—Very little grown in Bute.

*Potatoes.*—Early sorts started in boxes; about 6 tons; began to dig 25th June; late crop about 7 tons; not much disease.

*Turnips*—Very good crop; about 28 tons; no finger-and-toe Turnips brairded well; no resowing.

No damage by insects or weeds.

*Live Stock.*—Pastures a full average, and good quality. All kinds of stock did well. No unusual disease. *Clip of wool*—Under average in weight, but good quality.

ARRAN. *Wheat.*—None grown.

*Barley.*—None grown.

*Oats.*—A good crop on lea land where not grubbed; sown-out land a poor crop; rather earlier than last year. Seed sown, 5 to 6 bushels. Yield, say, 30 bushels of average quality.

*Harvest* began earlier than last year; crop secured in good condition.

*Hay.*—About 25 cwt.; quality good where cut green. Hay well got, and of average weight per bushel, about 24 lb. *Meadow-hay*—Fairly well secured; very little grown.

*Potatoes.*—A large crop, say 7 tons as dug; quality good, with little disease; some new varieties grown on small scale.

*Turnips.*—A good crop, say 15 tons; some fields damaged with finger-and-toe, but to no great extent.

Not many insects; grub our worst enemy to lea oats. Weeds less than last year.

*Live Stock.*—Pastures better than last year. Stock throve fairly well considering the condition they went out to grass. Cattle and sheep free from disease. *Clip of wool*—Quality not so good; quantity under the average owing to the wet winter and spring.

LANARKSHIRE (Upper Ward). *Wheat.*—None grown.

*Barley.*—None grown.

*Oats.*—30 to 35 bushels, and much better quality than last year. Seed sown, 5 to 6 bushels.

*Harvest* began in the middle of September, about a week later than usual, but was early finished owing to favourable weather.

*Hay.*—A good crop, averaging 2 to 2½ tons; little aftermath. *Meadow-hay*—A good crop, more productive than last year, and well secured.

*Potatoes.*—A heavy crop; average 8 to 10 tons, being considerably better than last year. A little disease commencing about the middle of August. A number of new varieties planted on a small scale. "Suttons," "Up-to-Dates," and "British Queens" continue to be the favourites.

*Turnips.*—25 to 30 tons; similar to last year. Brairded well. Practically no resowing.

Little or no damage by insects, but "wormed" corn was probably more common than usual. Weeds of the ordinary kind; not more than usual, and easily dealt with.

*Live Stock.*—Pastures good, especially in the end of the season. Stock throve well. Cattle and sheep free from disease. *Clip of wool*—Quantity and quality average, and prices better.

LANARKSHIRE (Middle Ward) *Wheat.*—The autumn of 1903 was exceedingly wet, and very little wheat was sown. The quality of grain and straw better than last year. From 35 to 40 bushels. Seed sown, about 4 bushels.

*Barley.*—None grown.

*Oats.*—35 to 40 bushels, grain very good. Less straw than during 1903, but of much better quality. Secured under very favourable conditions.

*Harvest* commenced about the middle of September under the most favourable weather conditions, and crops were secured with less expense than has been the case for many years In a few cases heating in the stack was occasioned through too early harvesting

*Hay.*—Ryegrass and clover hay was a fair average crop; ryegrass from 1½ to 1¾ ton. The crop was also well got, with little expense in harvesting. *Meadow-hay* or timothy hay gave a yield of 1½ to 2 tons, and was not so heavy as last year, but was very well secured.

*Potatoes.*—Have been a heavier crop than in most previous years, and yielded from 8 to 12 tons There has been very little disease, and they are commanding a very small price per ton Some new varieties have been planted, but none of what one might call very high-priced varieties. This district usually plants the safer commercial varieties.

*Turnips.*—Have been a very heavy crop, yielding from 15 to 30 tons. The quality has been excellent, showing little or no disease Most crops came away with the first sowing; and the season has been a good one for cleaning the land during the growth of this crop.

The oat crop suffered from grub-worm, and the damage was rather more than during the average season. No damage this year by weeds, as the weather allowed the root crops being cleaned in proper season.

*Live Stock.*—There was not the amount of herbage on the pasture this year as compared with last, but the quality was better. The stock improved well on the pasture when not put on too early in the spring. Cattle have been fairly free from disease. *Clip of wool*—There are practically no sheep and no clip of wool in the Middle Ward.

LANARKSHIRE (Lower Ward). *Wheat.*—Owing to the bad seed-time, not so much sown last year, and it was generally thin on the ground, therefore it did not bulk well; 36 to 40 bushels. Seed sown, 4 bushels.

*Barley.*—Scarcely any grown.

*Oats.*—Oats as a rule were also thin on the ground; in many places a

good deal of worming, but generally it thrashed well; 40 bushels as an average. Seed sown, 5 bushels.

*Harvest* began about the first week in September, just about the same time as last year, and is a capital one.

*Hay.*—Ryegrass hay a splendid crop, also timothy; ryegrass 2 tons, and timothy 3 to 4 tons.

*Potatoes.*—A big crop this year, 9 to 11 tons. Not much disease. Splendid weather for lifting. A few new kinds planted.

*Turnips.*—A fair crop, but not so good in this district as last year. 20 tons. A good deal of finger-and-toe in some places.

No damage by insects or weeds.

*Live Stock.*—Pasture was fair, but the frosty spring was against it. Cattle free from disease.

RENFREWSHIRE. *Wheat.*—Quantity more; quality of grain and straw much superior.

*Barley* —None grown.

*Oats.*—50 bushels; best harvest for years; quality of straw and grain very good.

*Harvest* began a little later, but was a short and good one.

*Hay.*—2½ tons; better than last year. *Meadow-hay*—None in district.

*Potatoes.*—Much the same for crop; average 8 tons; no disease. A good many new varieties Quality not so far reliable for report.

*Turnips.*—Weight about 25 tons; quality quite as good as last year. Crop brairded well; only once sown.

Less damage by insects this year. Few weeds to be seen in this clean well-farmed district this year.

*Live Stock.*—Pastures above the average growth Stock throve very well. Cattle and sheep free from disease.

ARGYLLSHIRE (Lochgilphead District). *Wheat.*—None grown

*Barley.*—None grown.

*Oats.*—About 30 bushels; better quality than last year; a shortage in straw, but good quality. Seed sown, 6 bushels.

*Harvest* started on the 12th September, five days later than last year, but a full fortnight behind average year.

*Hay.*—Quantity and quality better than last year; about 1 ton 10 cwt

*Potatoes.*—Yield much better than last year, with very little disease; about 7 tons 10 cwt

*Turnips.*—Weight and quality better than last year; about 21 tons. No second sowing required.

No injury by insects or weeds.

*Live Stock* —Pastures during the season of average growth and quality with last year. Stock throve very well. Cattle and sheep free from disease, except blindness in sheep. *Clip of wool*—About average.

ARGYLLSHIRE (Islands of Islay, Jura, and Colonsay). *Wheat.*—None grown.

*Barley.*—None grown.

*Oats.*—Good average crop, both oats and straw better than last year. Harvest week earlier than last, but later than average. Seed sown, 5 bushels.

*Harvest* in 1899, 1900, and 1901 was from a fortnight to three weeks earlier than in the three following years.

*Hay.*—Crop about one-third more than last year. *Meadow-hay*—Crop rather better than last year.

*Potatoes.*—This crop rather better than last year; not much disease.

*Turnips.*—About the same as last year. The crop brairded well, and in few cases was more than one sowing required.

In some fields grub was very bad, and turnip-fly also did considerable damage. The damage by insects on the whole was not greater than usual. The common weeds were as plentiful as usual—dockens, thistles, "red shank," &c.

*Live Stock.*—Pastures during the season of average growth and quality with last year. Stock throve very well. Not more disease than usual. Lambs very short in numbers. *Clip of wool.*—Rather above the average.

DUMBARTONSHIRE. *Wheat.*—About 32 bushels; quality of grain and straw better than last year.

*Barley.*—Almost none grown.

*Oats.*—From 48 bushels on the best land to 27 on higher land. Grain and straw both good quality; better than last year. Seed sown, 5 bushels

*Harvest* about a week later than usual.

*Hay.*—Ryegrass, 1 ton 15 cwt. to 2 tons; better in quantity and quality than last year. A fair amount of clover. *Meadow-hay*—A heavier crop than last year, but damaged by weather.

*Potatoes.*—From 9 to 4 tons. Very little disease. Quality better than last year. No new sorts planted.

*Turnips.*—From 25 to 18 tons. Quality better than last year. No second sowing required.

Grub very bad on lea oats. More damage than usual. No injury by weeds.

*Live Stock.*—Pastures rather better than last year. Stock throve very well. Cattle and sheep free from disease *Clip of wool*—Rather under the average.

STIRLINGSHIRE (Western District). *Wheat.*—None grown in the district

*Barley.*—Little grown in this district.

*Oats*—4 to 5 bushels; about 35 bushels grain and straw Much better than last year

*Harvest* ten days after usual time.

*Hay.*—30 to 35 cwt. Much better than last year, with more clover *Meadow-hay*—About same as last year

*Potatoes.*—Average about 6½ tons Disease in early kinds; about one-third; commenced about October. No new varieties.

*Turnips*—15 to 30 tons; quality very good; only one sowing; good braird.

No injury from insects. Slight injury from "red shank." Not so much.

*Live Stock.*—Pastures during the season were of average growth and quality with last year. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—Good, about same as last year.

STIRLINGSHIRE (Eastern). *Wheat.*—30 bushels; straw, 27 cwt.; deficient in quantity and quality. Seed sown, 4 bushels.

*Barley.*—Good. Bad seed-time, hence short crop. Seed sown, 3 bushels.

*Oats.*—Good crop, dry field; poor on clay. Yield 32 bushels. Seed sown, 5 bushels.

Good *harvest* and autumn.

*Hay.*—This crop well got; 2 tons.

*Potatoes.*—A good sound crop; 6½ tons; very few diseased.

*Turnips.*—Dry-field, good; 25 tons; carse, poor, 15 tons. Late seed-time. Whole crop grew after September.

*Live Stock.*—Pastures did fair, and stock improved. Sheep made good prices. No disease. *Clip of wool*—Poor, but good prices.

CLACKMANNANSHIRE. *Wheat.*—The yield will be from 36 to 40 bushels; straw short in bulk but of good quality. Seed sown, 3½ bushels.

*Barley.*—Crop in general short in straw; the yield is if anything less than last year, but of better quality, from 30 to 32 bushels. Seed sown, 3½ to 4 bushels.

*Oats.*—A little under the average in bulk; yield from 34 to 38 bushels; straw a little short, but having been secured in good condition, is of excellent quality. Seed sown, 4 to 5 bushels.

*Harvest* commenced a week earlier than last year. Being a good harvest, all the crops were secured in excellent condition, except in a few instances at the beginning where the crops were put in too soon, which caused heating in the stacks.

*Hay.*—A general average crop, secured in excellent condition. *Meadow-hay*—About the same as last year in bulk, but the most of it was badly got in, and consequently not of very good quality.

*Potatoes.*—A fair good crop in general, of more bulk than last year, and good in quality; yield from 5 to 7 tons; not much disease except in a few of earlier kinds. There were not many new varieties planted except for trial. A few of the newer kinds are taking the place of worn-out old ones.

*Turnips.*—A good general crop all over, better than last year; yield from 15 to 20 tons. Turnips brairded quicker and better than usual; no second sowing required.

Not much injury done by insects, being less than last year. Weeds were not nearly so troublesome as last year; the weather being drier, the weeds were easier kept under.

*Live Stock.*—There was not so much grass as last year, but it was of better quality. Stock throve well on the grass; being drier than last year the grass was more nutritious. Cattle and sheep were free from disease except foot-rot in sheep, which was troublesome *Clip of wool*—An average one as to quantity and quality, with fair prices.

FIFESHIRE (Middle and Eastern). *Wheat.*—The yield will be 36 to 40 bushels; grain much better quality than last year, and straw very good. Natural weights, 63 lb. per bushel; the return of straw will average 1½ ton. Seed sown—broadcast with hand, 4 bushels; with drill machine, 3 bushels.

*Barley.*—This crop was very much superior to last season, and was secured in excellent condition. The average yield will be from 44 to 48 bushels; weight of straw about 1 ton; quality of grain fine, and good colour. Natural weight, average 55 lb. per bushel. Seed sown—broadcast, 3 bushels; drill machine, 2 to 2½ bushels.

*Oats.*—Average return about 50 bushels; grain good quality, but straw short, and excellent fodder. Seed sown, 5 bushels.

*Harvest* at least two weeks earlier than last year, and about the usual time, and favoured with good weather. Was expeditiously and cheaply finished.

*Hay.*—A good crop, and secured in the finest possible condition. Average yield 2 tons, and much superior in quality to last year's crop. *Meadow-hay*—Very little made in this district, but more productive than last year.

*Potatoes.*—This has turned out the largest crop for several years, and the yield will be, for "Up-to-Dates," 10 tons; "Langworthys," 6 tons. No disease, and sample large and regular. New varieties very popular, and the acreage of them very much increased this year. "Northern

Star," "Eldorado," "Evergood," and "King Edward" being mostly planted.

*Turnips.*—Very large crop all over, of excellent feeding quality; weighs 20 tons. The crop brairded very well, and no second sowing had to be done, and the young plants continued strong and healthy.

No damage by insects. No injury by weeds, which were not more prevalent than in an ordinary season.

*Live Stock.*—Pastures were of average growth and better quality than last year. Stock throve very well. Cattle and sheep were free from disease, except one or two cases of anthrax, reported to the local authorities, and which were dealt with to prevent the spread of this deadly disease. *Clip of wool*—Of good quality, and about an average.

FIFESHIRE (Western District). *Wheat.*—Finer districts, 40 bushels of grain, about 2 tons of straw, both of fine quality. Seed sown, 4 bushels. Secondary districts, little wheat sown, but what there is will yield about 30 to 32 bushels of middling quality.

*Barley.*—Finer districts, 48 to 50 bushels, and about 30 cwt. of straw. The straw is fine quality, but the grain is disappointing in quality, considering the fine season. Seed sown, 3½ bushels. Secondary districts, 32 to 36 bushels of grain and about 1 ton of straw, both of secondary quality. 3½ to 4 bushels of seed sown.

*Oats*.—Finer districts, 48 to 52 bushels of grain and 30 cwt. straw, both of the finest quality. Seed sown, 4 bushels. Secondary districts, 36 to 40 bushels of grain and 1 ton of straw, both of fair good quality. Seed sown, 5 bushels.

*Harvest* in earlier districts began from 1st to 5th September; later districts, a week later.

*Hay.*—In the best districts hay was a fine bulky crop, about 2½ tons, of the finest quality. In the later districts, about 30 cwt., but likewise of fine quality. *Meadow hay*—Considerably better, and of fine quality.

*Potatoes.*—Finest districts, "Up-to-Dates" and "Langworthys" are the principal varieties grown; the former would yield 7 to 9 tons "ware" and the latter 6 to 7 tons "ware," and in each case 1 ton to 30 cwt. of seconds and brock besides. No disease in the "Langworthys," but a considerable sprinkling in the "Up-to Dates." In the later districts "Up-to Dates" are mostly grown, and will yield about 6 tons "ware."

*Turnips.*—Finest districts, this crop is a very large one, and of fine quality, and will average from 25 to 30 tons. Poorer districts, very various. Some good crops to be seen of 20 to 25 tons, whilst in some cases, where the land is wet and poor, the crop is almost a failure. The crop came away well, and almost no resowing was necessary.

No injury by insects. The dry season enabled farmers to keep down the usual weeds in the grain crops.

*Live Stock.*—Pastures very abundant, and of good quality. Stock throve well. Cattle and sheep generally free from disease. *Clip of wool*—Over the average, and of fine quality.

PERTHSHIRE (Western District). *Wheat.*—An average yield, but in some cases rather thin on the ground. A good bulk of straw of fine quality, and well secured. Yield of grain will vary from 32 to 38 bushels. Seed sown, 3 to 3½ bushels. The area sown would be about an average of recent years.

*Barley.*—On dry-field land the yield would not exceed 30 bushels, and on carse land the yield would be about 34 bushels. The bulk of straw would scarcely be up to an average, and on many carse farms the crop was not well secured, as the weather was unfavourable in the latter part of the harvest. Seed sown, 3 bushels.

*Oats.*—Generally a fine crop, with a full average bulk of straw. Yield, from 42 bushels in some districts down to 34 bushels on the higher-lying farms; straw of good quality. Seed sown, 4 to 5 bushels.

*Harvest* started about middle of September, and the weather was on the whole favourable during the cutting, but it broke down shortly afterwards, and the work of securing the later cut crops was rather tedious.

*Hay.*—On carse land, 30 to 35 cwt.; well got and of good quality. On dry-field land 20 to 25 cwt., of fair quality, but not too well got in some districts. *Meadow hay* was more than an average crop and well got. Timothy hay is now pretty extensively grown in the district, and on the carse and heavier lands the crop would yield 40 to 50 cwt.

*Potatoes.*—The crop was more than an average one for the district, and would run from 6 to 8 tons, according to locality, the land varying a good deal in this wide district. Disease was not so pronounced as in some past seasons. The bulk of the crop consists of "British Queens," "Up-to-Dates," and "Maincrops," but on several farms "Evergood," "Royal Kidney," "Sir John Llewellyn," "King Edward VII.," &c., have been tried with great success.

*Turnips.*—A full average crop generally; 16 to 22 tons. Plants brairded well, and kept on growing, the autumn being very favourable for the plants rooting well. No turnip-fly and no second sowing.

The summer was favourable for dealing with weeds, and these did less damage than in some former years.

*Live Stock.*—Pastures were good, and cattle did fairly well on them, but in most cases did not leave much for grazing. Cattle and sheep free from disease. *Clip of wool*—An average both as to weight and quality, and selling at much better prices than for many years.

PERTHSHIRE (Eastern District). *Wheat.*—Fair crop, of good quality, both of grain and straw, but not bulky. Average yield, 30 to 34 bushels. Seed sown, 3 to 4 bushels.

*Barley.*—Good crop and well secured; much better quality than last two years. Average yield, 32 to 36 bushels. Seed sown, 3 to 4 bushels.

*Oats.*—Light crop, except after old lea, in good condition. Quality good, but a large quantity was carried too soon, and thereby heated in stack. Average yield, 40 to 44 bushels. Seed sown, 4 to 5 bushels.

*Harvest* began about the usual time.

*Hay.*—Much better crop than last year; both ryegrass and clover good and well secured. Average yield, 2 to 3 tons. *Meadow-hay*—Very little made.

*Potatoes.*—Very heavy crop; average yield, 9 to 10 tons. There was not much disease at time of lifting, but it has developed badly in the pits amongst the "Up-to-Dates." Several newer varieties, especially "Northern Star," "Evergood," "Royal Kidney," and "Sir John Llewellyn," have been freely planted, and have done exceedingly well, producing crops from 12 to 20 tons, of good quality and free from disease.

*Turnips.*—Splendid crop, and very sound. Average yield, 25 to 28 tons. Capital braird; no second sowing necessary. Season very favourable all through.

Grain crops suffered considerably from wire-worm and grub, but not much worse than usual. Not so many weeds as usual on account of dry season. Charlock did most damage to grain crops.

*Live Stock.*—Pastures about average; good quality. Stock throve well. Better than last year. Cattle and sheep free from disease. *Clip of wool*—Rather under average; too much wet weather during the winter.

PERTHSHIRE (Central). *Wheat.*—Very little grown; about 30 bushels; straw about 1 ton; quality of both good. An average crop, well harvested. Seed sown, 3½ bushels.

*Barley.*—About 38 bushels; quality of grain and straw good; well harvested. Seed sown, about 4 bushels.

*Oats.*—About 45 bushels; quality of both grain and straw very good, but straw short in many places. About 5 bushels sown and 6 bushels of newer varieties. Good harvest.

*Harvest* started about the usual time, but was very soon finished, with no damaged grain.

*Hay.*—Ryegrass and clover hay was a good fair crop on the whole, but cut a little below expectation in some places. About 1 ton 5 cwt. on the average of the district. *Meadow-hay*—Was on the whole a good crop where not cut too early, with a slightly better yield, and in most instances got in in best condition.

*Potatoes.*—A fair good crop; 6 to 8 tons dressed; practically no disease.

*Turnips.*—A good crop throughout the district. It would vary from 15 to 25 tons. Crop brairded well. No second sowing.

Little damage done to crops by insects. Little damage done by weeds, as it was a good season for keeping them down. Wild mustard is bad in this district, and so are thistles; while bracken seems in more need of a Royal Commission than grouse-disease, and a Government subsidy for its eradication on hill farms.

*Live Stock.*- Grass was quite up to, and in most places over, the average. Little or no burning took place, and it was a good grazing season Stock did well, and were healthy on the summer grazings; but it was an exceptionally bad spring for sheep, which were in very poor condition on high farms at lambing. The death-rate of ewes was very heavy in some instances, and the percentage of lambs very low and badly milked. But for a few isolated cases of anthrax reported, cattle and sheep have been very free from disease, except hoggs in the first month of the wintering, when braxy claimed a larger proportion than usual. *Clip of wool* The quality would not be anything like up to the average this season, and would be fully 15 to 20 per cent lighter clip on the average, owing to the very lean condition of sheep in the spring Not much damage done by maggots this season, except a few isolated cases almost in the autumn.

PERTHSHIRE (Highland). *Wheat*—None grown

*Barley.*—30 bushels; good quality, but considerably less grown than formerly.

*Oats.*—36 bushels after lea; straw of very fine quality, being well secured. Some fields rather thin, caused by inferior seed and grub. Sown oat land after green crop deficient in bulk, owing to inferior seed and the land being rather wet when ploughed. Yield about 24 bushels; straw well secured and splendid quality.

*Harvest* three weeks after the usual time.

*Hay.*—30 cwt.; much heavier crop than last year, and secured in fine condition. *Meadow-hay*—A heavier crop than last, and generally well got.

*Potatoes.*—6½ tons dressed potatoes, nice size and good quality. Very little disease; no new varieties planted.

*Turnips.*—18 tons; quality good; braird good; no second sowing.

No damage from insects. No injury by weeds.

*Live Stock.*—Pastures very much better than last, and continued growing until November. Both cattle and sheep did well, and quite free from disease. *Clip of wool*—There would be nearly an average clip, and the quality good.

FORFARSHIRE (Western). *Wheat.*—38 bushels; quality of both straw and grain much superior to last year. Seed sown, about 3½ bushels.

*Barley.*—42 bushels; straw not so abundant as last year, but both straw and grain of much better quality. Seed sown, from 3 to 4 bushels.

*Oats.*—50 bushels; straw very deficient in quantity, but good, unless where a little heated, but grain good. Seed sown, from 4 to 5 bushels. A very dry harvest, but very deficient in winning weather, as there was scarcely any wind until late harvest.

*Harvest* about a month earlier, but last year was very late.

*Hay.*—On well-farmed land this crop would be a full average—about 2 tons.

*Potatoes.*—Every one was pleased with their potato crop. I think it would be a record one, from 8 to 15 tons. No disease worth mentioning, but lifting would be rather later than usual, as the shaws kept green a long time.

*Turnips*—This crop would also be a bumper one, from 24 to 36 tons. Braird good, and no second sowing.

No injury by insects. As the summer was dry no injury by weeds.

*Live Stock.*—Pastures were good. Stock throve very well, and were comparatively free from disease. *Clip of wool*—The quality of clip was good, rather over an average.

FORFARSHIRE (Eastern). *Wheat.*—44 to 46 bushels; quality good, much better than last year; straw good, but shortish, and secured in fine order. Seed sown, 4 bushels

*Barley.*—Good crop of grain; 48 to 54 bushels; straw short, but good. Seed sown, 4 bushels.

*Oats.*—Good average crop; 52 to 56 bushels, straw very short, but good quality On well-farmed heavy land straw about an average. Seed sown, 4 to 6 bushels.

*Harvest* very good; began 27th August, as against 8th September 1903

*Hay.*—Fair crop, fully heavier than previous year; 4 to 5 tons; some instances showing a want of clover; secured in fine order. *Meadow-hay* None grown.

*Potatoes.*—Much heavier crop than last year; 10 to 12 tons, in some cases up to 14 tons. No disease; some new varieties very blanky.

*Turnips.*—Heavy crop, especially yellows, 35 to 35 tons; swedes and yellows heavier. No cancer or finger-and-toe.

No injury by insects. Few weeds; no injury.

*Live Stock.*—Pastures average. Stock throve well and were free from disease. *Clip of wool*—Fully an average, of good quality, and prices improved.

ABERDEENSHIRE (Buchan District). *Wheat.*—None grown in this district.

*Barley* or *Bere*—A fair crop this year, both as to grain and straw, yielding from 32 to 40 bushels. The grain is of better quality and colour than last year, from 52 to 56 lb. per bushel; the straw is all better quality. Seed sown, 3 to 5 bushels.

*Oats.*—Not such a heavy crop as last year, but both grain and straw of better quality, and the yield of grain is much more satisfactory. Both colour and weight are better, weight being from 40 to 43 lb. Owing to the dryness of the season the straw was short, and there will be a deficiency throughout the district.

*Harvest* began generally about 7th September, being fully fourteen days earlier than last year.

*Hay.*—Scarcely an average crop, but secured in good order, so that the quality is good; 30 to 35 cwt. would be about an average.

*Potatoes.*—Very heavy crop of very good quality; scarcely any disease. New varieties not gone in for much.

*Turnips.*—An excellent crop, free from disease. Swedes 18 to 30 tons (and in many cases more). Yellows 18 to 24 tons. Very little resowing this year, and scarcely any damage by insects.

*Live Stock.*—Pastures not nearly so luxuriant as last year. Stock made more progress on them, especially the first part of the season. No disease. Stock made good progress, especially first half of season. Cattle and sheep free from disease. *Clip of wool*—About an average both as to quantity and quality.

ABERDEENSHIRE (Formartine District). *Wheat.*—None grown.

*Barley.*—Last year 28 bushels, this year 38 bushels, with an average bulk of straw. The bushel weight is very high, averaging at least 57 lb., or 2 lb. above the average of former seasons. The quality of grain is very fine. Seed sown, 4 to 4½ bushels.

*Oats.*—Last year 40 bushels, this year 44 bushels; straw 20 per cent under average. The bushel weight is generally about 43 lb. Quality of grain and straw very fine. Seed sown, 5½ to 7 bushels.

*Harvest* began during the last week of August, a few days earlier than usual, and the weather throughout was all that could be desired. One of the best harvests on record.

*Hay*—"Seeds," *i.e.*, ryegrass and clovers, are cut for hay, and yielded about 28 cwt, or 2 cwt. less than last year; quality very fine. *Meadow-hay* Almost none grown.

*Potatoes* - This was an extraordinary crop. Last year 3½ tons, this year about 7 tons, or about 30 cwt. above the average of former seasons. Quality good; very little disease.

*Turnips.* This crop would average about 20 tons, *i.e.*, double last year's. The crop brairded fairly well, and very little resowing was necessary

Some patches of oats were grubbed, and some fields of late sown turnips were damaged by the diamond-back moth, but not over a great area. Very little damage from weeds—less than usual.

*Live Stock.*- Pastures were under an average of growth, but were of good quality. Stock throve well, except where they were too short of grass. Cattle and sheep free from disease.

ABERDEENSHIRE (Strathbogie District). *Wheat*—None.

*Barley* The seasons 1902 and 1903 proved most disastrous to barley growers in Strathbogie, consequently only a very limited area was sown this year. This contraction of the area has been so far a misfortune, inasmuch as barley has proved to be a very good crop The straw was certainly deficient, owing to the excessive dryness of the season; but the grain gave a good yield, and proved of first-class quality—samples weighing from 56 lb. up to 58 lb. per bushel.

*Oats* were short of straw, and fodder is remarkably scarce. Many farmers maintain that their stackyards have not been so small since the memorable year of scarcity—1868. Oats after roots have in general given a most disappointing return in both grain and straw. After lea many of the crops were somewhat thin, caused by the dryness of the weather in June. Grain is of splendid quality, and many parcels weigh from 41 lb. to 44 lb per bushel, which is quite a contrast to the weights obtained in the two previous seasons. The yield of grain per stack is satisfactory, but the number of stacks is at least one-third short of an average, so that the return of grain per acre will prove to be short of an average season.

*Harvest* began about ten days before the usual time for this district.

*Hay.*—The quantity was very small owing to the dryness of the weather at the critical period of growth. The crop was generally fairly well mixed with clover. The quality of the crop was never better, the weather during the cutting and curing time being dry, along with a bright sunshine. 20 cwt. a good return. *Meadow-hay*—None grown in this locality.

*Potatoes.*—The yield of the potato crop was most satisfactory, in some instances perhaps as high as 10 tons. The quality is simply superb. There was no disease. Perhaps the introduction of "British Queen" is the only new variety in the district. No "Northern Star" or "Eldorados" here yet.

*Turnips.*—This crop has proved to be a very heavy one all over, and quite a contrast to the wretched crops of the two previous seasons. It is no exaggeration to state that this year's crop would outweigh the combined crops of 1902 and 1903. There are numerous crops which would exceed 30 tons, which is a remarkably rare occurrence in this district.

There has not been any unusual damage by insects. There was no special damage caused by weeds. The weather during the cleaning of the turnip land was excellent for the purpose, and as a rule weeds were well cleaned out.

*Live Stock.*—Grass was unusually scarce during the greater portion of the season. After the rains which fell in August the pastures freshened considerably, but did not grow much thereafter. The stock throve well where hay was sufficient, but many animals were half starved for want of food. There have not been any diseases among either cattle or sheep, with the exception of anthrax, of which there have been a few cases. The *clip of wool* was good, and the quality quite an average. Flockmasters are jubilant at the increased price realised by their clips, exactly double the prices current two years ago.

BANFFSHIRE (Lower District). *Wheat.*—None.

*Barley.*—An average crop of 36 bushels, of very fine quality, weighing up to 58 lb. per bushel. Seed sown, 4 bushels.

*Oats.*—An average crop of 36 bushels, of excellent quality, weighing up to 44 lb. per bushel. Very light allowance of straw, which accounts for the small yield. Seed sown, 5 to 6 bushels.

*Harvest.*—From a fortnight to three weeks earlier than usual. Short harvest, the weather being very fine.

*Hay.*—A fair crop of excellent quality, both as regards ryegrass and clover, yielding from 150 to 200 stones. *Meadow-hay*—None.

*Potatoes.*—Superior crop of fine quality, and free from disease. Average yield 6 to 9 tons.

*Turnips.*—An average crop of from 30 to 40 tons. A good deal of second sowing owing to the very dry weather.

No insects. Land clean, and weeds did no harm.

*Live Stock.*—Owing to the dry weather the pastures did very badly, and consequently stock did badly also. Cattle and sheep free from disease. *Clip of wool*—Average both in quantity and quality.

BANFFSHIRE (Upper District). *Wheat.*—None grown in this district.

*Barley* has proved the best cereal of the season, fairly well strawed for a crop, and yielding fine matured grain 4 to 5 quarters of good weight; 56 to 58 lb. per bushel, fetching fully 26s. per quarter at 56 lb. weight. Seed sown, 4 to 5 bushels.

*Oats.*—Variable, but in general short-strawed except on lea fields of good loam, which also suffered from thinness of plants. Very little

damage by grub; yield of grain 3 to 5 quarters more according to locality. Seed sown, from 5 to 7 bushels.

*Harvest* began two to three weeks earlier than usual owing to the forcing heat and drought.

*Hay.*—The crop, like last year's, light. The crop of previous year suffered from wet and cold, this one the reverse; too much drought and heat stunted the growth of clover and ryegrass; only in rare cases would there be 1 ton 10 stones. *Meadow-hay*—Little or none in this district.

*Potato* crop an ample one, of fine quality; 8 to 10 tons common; no disease. "Up-to-Dates," "Maincrop," and "Sutton's Abundance" are the latest introductions, and are likely to be much in favour for yield and quality.

*Turnips* exceptionally good as to quantity and quality; 20 to 25 tons average, and on heavy soils 35 tons were grown; little or no second sowing. A stiffness in coming to hoe experienced owing to the great scorching dryness in the soil from the 10th June, but from the middle of July onwards the crop throve admirably, and kept growing until snow and frost came in the latter part of November.

Very little trouble from weeds, the dryness of the soil being favourable to cleaning by horse-hoe, &c

*Live Stock.*—Pastures suffered more than any other crop from the great drought and heat, which classes with 1868 for a hot dry summer. Stock had to be supplemented early with cut grass, tares, &c., and, where practicable, turned out to heath and rough hillsides. The condition of stock is hardly average. Happily nothing special to complain of. The *clip of wool* was a fair one only, as, although the preceding winter and spring were pretty open, keep was short on account of much bare hard frost, and flocks scarcely throve so well in any respect.

MORAYSHIRE *Wheat.*—Not much sown. Average crop for the county will be about 38 bushels- 3 bushels more than last year. Quality of grain and straw much better than last year. Seed sown, 3 to 4 bushels

*Barley.*—A very short crop, especially on dry light soil, owing to the dry summer; nevertheless both yield and weight of grain are beyond what was expected at reaping-time. Average yield would be about 31 bushels, being 2 3 bushels less than last year Weight from 2 lb. and in some cases 6 lb. above the standard weight of 54 lb per bushel. Straw from one-third to one-half short from last year. Seed sown, from 3 to 4 bushels

*Oats*—A very short crop. In many parts not a half, owing to the dry summer; nevertheless, the yield and weight of grain are not so disappointing. In many cases the crop has thrashed out at two and three-and-a-half quarters more than the valuations made before reaping. Average yield, say 33½ bushels, 7 bushels less than last year. Straw short from one-third, and in some places a half short; excellent quality. Seed sown, from 5 to 5½ bushels; new varieties 6 to 8 bushels.

*Harvest* began about two, and in some places three weeks, before last year. It was general on the 15th August, and finished by the 10th or 11th September.

*Hay.*—This crop was 4½ cwt. less than last year; average quantity estimated at 25 cwt. Quality very superior, owing to the fine dry weather at haymaking. *Meadow-hay*—Not much grown in the county, about 22 cwt.; superior quality.

*Potatoes* a very good crop; yield about 6 tons 7 cwt.—about a ton more than last year. Free from disease, and of excellent quality.

*Turnips.*—Average weight of the county, as estimated, comes out at

20 tons, 3 tons more than last year, but on some farms well cultivated and singled carefully, weights will be found to run up from 38 to 41 tons 15 cwt., as shown by careful weighing at the nitrate competitions. The crop brairded well; very little finger-and-toe. In short, the turnip crop is one of the best for many years.

On some farms of strong land the ordinary turnip-fly, and so required resowing; on light sandy land a good deal of damage was done by wind in the severe gale on the 15th June, which caused a large extent to be resown. No injury by weeds.

*Live Stock.*—Pastures were under an average growth owing to the dry summer; nevertheless, where there was plenty of good water, live stock throve and did very well. Where water was scarce stock suffered and did not thrive, but went back in condition Cattle and sheep free from disease, except the former. On breeding farms abortion amongst the cows has been very prevalent, and on some farms not a cow left in calf. The *wool clip* this year was good, and a little over the average of last year.

NAIRNSHIRE. *Wheat.*—None grown.

*Barley.*—45 bushels; good; straw short. Seed sown, 4 bushels.

*Oats.*—50 bushels; good; straw very short. Seed sown, 5 to 6 bushels.

*Harvest* began fourteen days earlier.

*Hay*—Several tons less.

*Potatoes.*—Much the same; no disease. A few new varieties.

*Turnips*—5 tons more; good. No resowing.

No injury by insects or weeds.

*Live Stock.* — Pastures a good deal burnt up. Stock throve fairly well. Cattle and sheep free from disease.

INVERNESS-SHIRE (Inverness District). *Wheat.*—Only 20 acres of wheat sown in the county in 1904. Crop good; yield about 40 bushels.

*Barley.*—This crop very good quality, but yield not satisfactory. The usual quantity sown, 3 bushels on best land and 3½ bushels on poor land; yield from 24 to 40 bushels.

*Oats.*—A good crop, and yield very satisfactory, both in quantity and quality. Quantity sown from 4 to 6 bushels, according to kinds, the newer varieties requiring more seed, but they yield heavier crops. Average return from 34 to 50 bushels.

*Harvest* rather earlier than the average.

*Hay.*—The yield of hay crops was very good both in quantity and quality; about 3 tons on heavy land and from 2 to 2½ on lighter land, being one-third more than 1903, and much better quality. *Meadow-hay*—Very little grown.

*Potatoes.*—The yield was about one-third more than 1903, and the quality good. Very little disease anywhere. Several new varieties planted, which promise well.

*Turnips.*—Very good crop, being quite one quarter more than 1903; very little disease. An average crop on best land, about 28 to 30 tons

No damage by insects. A good many weeds, such as "couch" and wild mustard.

*Live Stock.*—Pastures during the season of average growth and quality with last year. Stock throve very fair. Cattle and sheep free from disease. *Clip of wool*—Very fair.

INVERNESS-SHIRE (Skye). *Wheat.*—No wheat grown.

*Barley.*—Very little grown.

*Oats.*—About 35 bushels this year; quality good; straw short. Seed sown, about 5 or 6 bushels.

*Harvest* began about ten or twelve days earlier than last year.

*Hay.*—The quantity of ryegrass is 1¼ tons; quality fully better than last year. *Meadow-hay*—Crop much more productive than last year.

*Potatoes.*—This crop yielded between 6 and 7 tons; quality excellent; no disease. No new varieties planted.

*Turnips.*—Weight of this crop was from 8 to 10 tons; quality good; crop brairded well. No second sowing.

No injury by insects or weeds.

*Live Stock.*—Pastures above the average. Stock throve much better than last year. Cattle and sheep free from disease. *Clip of wool*—Under the average.

INVERNESS-SHIRE (Lochaber, &c.) *Wheat*—None grown.

*Barley*—None grown.

*Oats.*—24 bushels; quality good both of grain and straw: quantity of straw about 30 per cent under average. Seed sown, 6 bushels.

*Harvest* began about the usual time

*Hay*—Quantity of this crop about 25 cwt.; quality good. *Meadow-hay*—Crop more productive than last year.

*Potatoes.*—About 5 tons. Scarcely any disease. No new varieties.

*Turnips.*—About 18 tons Crop brairded well. Only one sowing.

Oat crop injured by "yaar" more than usual.

*Live Stock.*—Pastures above the average Stock throve Cattle and sheep free from disease. *Clip of wool*—A full average.

ROSS-SHIRE (Dingwall and Munlochy). *Wheat.*—None grown in district.

*Barley.*—Quality and quantity of grain full average. Quality very fine, quality of straw also fine. Yield about 40 bushels Seed sown, 4 bushels.

*Oats.*—Quantity of straw much below average, but quality fine. Quantity of grain full average, say 46 bushels; quality fine. Seed sown, 5 bushels.

*Harvest* began about 20th August. Weather fine, and operations completed in less time than usual

*Hay*—Quantity of crop quite average, quality very fine; weather unusually good; quantity up to 2½ tons.

*Potatoes* - Crop was later, and quality not average. Almost no disease. Quantity about 6 tons.

*Turnips*—Crop brairded well; almost no second sowing; very little finger-and-toe. Weight up to 30 tons, both swedes and yellows—average, say, 25 tons.

No injury by insects or weeds.

*Live Stock*—Pastures above last season; weather warmer. Stock throve very well. Cattle and sheep free from disease *Clip of wool*—Quite average.

ROSS-SHIRE (Tain, Cromarty, and Invergordon). *Wheat.*—Good crop; over an average: 40 bushels. Seed sown, 4 bushels.

*Barley.*—Quite average break on suitable land, and an average crop, 38 to 40 bushels. On cold land and clay barley is being given up in favour of oats. Seed sown, 3½ to 4 bushels.

*Oats.*—Short crop of straw owing to dry weather; grain not much less, and of good quality; yield, say, 42 to 44 bushels. Seed sown, 4½ to 5 bushels more of the new varieties.

*Harvest* began earlier, from 17th to 20th August—about one week earlier than average.

*Hay.*—Full average quantity; over average quality; very well got; weight from 1¾ to 2 tons. *Meadow-hay*—None grown in district.

*Potatoes.*—A very full crop of fine quality, one-fourth heavier than last year, at least 7 to 9 tons. No disease. Not many varieties grown except as an experiment.

*Turnips.*—Splendid crop on turnip soils, but under average quality. Not much finger-and-toe. No second sowing. Only average on cold clay

Very little destroyed by insects. The dry weather helped to keep down weeds ; damage less than usual.

*Live Stock.*—Pastures good quality, owing to dry weather. Not much growth. Stock did well on grass, and very free from disease. *Clip of wool*—A little over average.

SUTHERLANDSHIRE. *Wheat.*—None grown.

*Barley.*—A fair crop ; colour of grain good ; number of bushels, 36 to 44.

*Oats*—A light crop ; quality of grain good, but straw very short ; 32 to 36 bushels would be about the average Quantity of seed sown, 5 to 6 bushels. The crop was considerably less in bulk than previous years.

*Harvest* began one week to ten days earlier than previous year.

*Hay.*—This crop was also short, but quality very good ; 1 ton to 1½ ton the average. *Meadow-hay*—Rather less.

*Potatoes*—This crop very good, 1½ to 2 tons more than last year. No disease Very few new varieties are planted in this district.

*Turnips.*—This crop is also considerably better than last year, 16 to 20 tons being a fair average. The braird came away well from the first, and no second sowing required.

No injury by insects or weeds.

*Live Stock.*—Pastures were rather bare owing to hot dry season, and in many farms grass was deficient. Stock throve very well. Cattle and sheep free from disease. *Clip of wool*—Quality good, but rather under an average as to weight.

CAITHNESS-SHIRE. *Wheat.*—None grown.

*Barley.*—Fairly good, of about 36 bushels. Seed sown, from 4 to 5 bushels.

*Oats.* Owing to the late and light harvest of 1903 many farmers took their entire stock of seed oats from the south, and in many cases the proprietors helped. From 4½ to 5 bushels of mature seed gave a light crop of straw, but a good, plump, well-ripened grain of about 4 quarters The harvest was three weeks earlier than last year, and the weather very favourable for harvesting operations.

*Harvest* this year began about the normal time, last year's having been exceptionally late.

*Hay.*—There was good quality of crop, though light, averaging about 1½ ton. *Meadow-hay* was a light crop.

*Potatoes.*—There has been an exceptionally good crop, remarkably free from disease. On a small scale trials are made of some new varieties, but with no marked improvement. "Champions" are still the most profitable kind, the crop this year yielding 8 tons.

*Turnips.*—As a whole this may be regarded as the record crop compared with last or many former years. The crop brairded well, and very rarely was more than one sowing needed ; in not a few cases there would be 26 tons of good juicy turnips.

Grub or other insects did not make any great ravages. Coltsfoot and thistles need continual checking.

*Live Stock.*—The pastures were of good growth, but eaten bare at end of year. Stock thriving. Anthrax has shown itself in one or two instances. Fluke in sheep, especially ewes, may be regarded as the

natural result of last year's rains. *Clip of wool*—Average, and prices firming.

ORKNEY. *Wheat.*—None grown.

*Barley.*—The average yield of bere was about 36 bushels, weighing about 50 lb. Seed sown, $3\frac{1}{2}$ to $4\frac{1}{2}$ bushels.

*Oats.*—Straw is a short crop, and less in bulk than last year, but oats are a fair good crop, average 32 bushels, weighing 40 lb., being a great improvement, both in quantity and weight, on last year's crop. Seed sown, 4 to 6 bushels

*Harvest* began three weeks earlier than last year, but rather later than usual.

*Hay.*—A light crop, about 20 cwt

*Potatoes.*—A good crop; weight about 6 tons; very little disease.

*Turnips*—Owing to the want of frost last winter the ground was bad to make for turnips, which were sown in rather cloddy ground, and consequently brairded irregularly, but gradually improved all season, and are a good crop, weighing about 13 tons, being a half more than last year.

Grub did a little damage to the lea oats. Cold dry weather in May, after wet weather, checked the braird and allowed the weeds to get a start, which choked and stunted the growth of a good deal of the oats on the clean land.

*Live Stock.*—Pastures were rather bare all season, but owing to the sunshine and fine weather stock throve much better than last year, and were free from disease. *Clip of wool*—About an average.

SHETLAND. *Wheat*—None grown.

*Barley.*—Grain equal to last year; straw in larger quantity; quality average.

*Oats.*—Grain better than last year both in quality and quantity; straw about the same.

*Harvest*—About a week before the usual time

*Hay*—This crop, both as regards ryegrass and clover, was larger in quantity and better in quality than last year *Meadow-hay* was a larger crop, and of better quality than last year.

*Potatoes*—There was a larger yield and of better quality than last year. There was no disease. New varieties planted in small quantities with most excellent results,—"Sir John Llewellyn" and "Morning Star."

*Turnips.*- This crop better than last year's both in quantity and quality. Only one sowing. The crop brairded well

Crops were not injured by insects of any kind. There were more weeds than usual—largely chickweed. It did little damage to the grain crops, but it took more work than usual to keep the root crops clean.

*Live Stock*—Pastures were of average growth and good quality, fully equal to last year Stock kept healthy and throve well. About a good average. No disease of any kind. *Clip of wool*—A good average, and of good quality.

## THE METEOROLOGY OF 1904.

By ALEXANDER BUCHAN, LL.D.

The following table gives a comparison of the winds, pressure, temperature, rainfall, cloud, and sunshine for 1904 as compared with averages of the forty-five years from 1856 to 1900:—

| 1904 | Direction of Winds—Days. | | | | | | | | | Wind Force, scale 0 to 12 | Mean Pressure in inches. | Mean Temperature, degrees. | Rainfall. | | Mean Cloud, scale 0 to 10. | Sunshine in hours. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N. | N.E | E. | S.E | S | S W. | W. | N.W | Calms | | | | In inches. | No of days | | |
| Jan. | −1 | −1 | −1 | −1 | +1 | +1 | +2 | 0 | 0 | +0·1 | −·086 | +1·8 | −0·18 | +2 | +0·1 | −2 |
| Feb. | 0 | +1 | +2 | +1 | +1 | −2 | −2 | −1 | 0 | −0·4 | −·371 | −2·1 | +0·66 | +3 | +0·7 | −12 |
| March | −1 | 0 | +2 | +1 | +1 | 0 | −2 | −2 | +1 | −0·5 | +·130 | −1·0 | −0·53 | +1 | +0·1 | −1 |
| April | −2 | −2 | −4 | −1 | 0 | +3 | +5 | +1 | 0 | +0·5 | −·171 | +0·9 | +1·73 | +7 | +0·1 | −8 |
| May | −1 | 0 | +1 | 0 | 0 | +1 | 0 | 0 | −1 | 0·0 | −·071 | −0·5 | +0·71 | +4 | +0·6 | −17 |
| June | 0 | +1 | +2 | 0 | 0 | −1 | −1 | 0 | −1 | 0·0 | +·054 | −0·6 | −0·62 | −1 | −0·2 | +23 |
| July | −1 | +1 | +2 | +1 | +1 | 0 | −1 | −2 | −1 | −0·3 | +·078 | +0·1 | −1·04 | −1 | +0·1 | −1 |
| August | 0 | 0 | −1 | 0 | +1 | 0 | −1 | +2 | −1 | −0·4 | +·050 | −0·6 | +0·96 | +4 | +0·2 | +5 |
| Sept. | −1 | 0 | +2 | +2 | +2 | −1 | −2 | −1 | −1 | 0·0 | +·168 | +0·1 | −0·45 | −3 | −0·3 | +24 |
| Oct. | −1 | −1 | −1 | −1 | 0 | +2 | +2 | 0 | 0 | −0·3 | +·170 | +1·5 | −2·02 | −1 | −0·1 | +14 |
| Nov | 0 | 0 | −2 | −1 | −1 | −1 | +3 | +2 | 0 | −0·3 | +·115 | −0·1 | −1·58 | 0 | −0·1 | +7 |
| Dec | 0 | 0 | −1 | −1 | 0 | 0 | +1 | 0 | +1 | −0·1 | −·009 | +0·6 | −0·57 | 0 | +0·3 | +5 |
| Year | −8 | −1 | +1 | 0 | +6 | +2 | +4 | −1 | −3 | −0·1 | +·005 | 0·0 | −2·88 | +15 | +0·1 | +37 |

JANUARY.—The mean temperature was 39°·0, or 1°·8 above the mean, the days being 1°·7 and the nights 2°·0 above their means. The month was the mildest January since 1898, when the mean for the month was as high as 42°·9. Temperature was above the average in all districts, the excess amounting to fully 2°·0 in the Lothians, Lower Clydesdale, Central Perthshire, and on Upper Deeside. Cold weather prevailed until the 6th, and thereafter cold and mild spells alternated, with rather low temperatures on 12th, 15th, and 16th, 25th, and 31st. The 18th, 19th, and 27th were the mildest days of the month, the six days from 18th to 23rd having a mean temperature much above the average. The absolutely highest temperature was 58°·8 at Loanhead on 9th, and the lowest 22°·0 at Stronvar and Drumlanrig on 17th and at Wolfelee on 25th.

The mean rainfall was 3·68 inches, or 5 per cent below the average. Shetland and most of the Western Islands had rainfalls decidedly above the average, and on the mainland there was a slight excess in parts of Inverness-shire and at Braemar and a few other places. But about half of the rainfall stations had falls within 10 per cent of the average, whilst most northern and eastern districts had a decided shortage, Dunrobin, Gordon

Castle, and Perth recording less than half their usual amounts. Most of the rain fell during the second and third weeks and towards the end of the month. Daily amounts exceeding an inch were of rare occurrence, the heaviest fall in twenty-four hours being 1·56 inch at Greenock on 10th.

Snow was general on the 15th, and light falls occurred here and there earlier in the month. Except between 16th and 27th moderate gales were rather frequent.

FEBRUARY was a much colder month than January, having a mean temperature of 36°·2, or 2°·1 below the mean, with days 2°·8 and nights 1°·4 below their means. All districts were decidedly below the average in temperature, the deficiency being more pronounced in the east than in the west, but at few places less than 1°·5. Severe frosts were generally of short duration; but there was practically no spell of mild weather during the month, and most districts had only a few days with temperature equal to the average. Highest temperatures were recorded generally on 20th, 21st, or 27th, and lowest on 29th, and at a few places on 19th. At Edinburgh frost in shade was registered on fifteen days and on grass on twenty-two days. The absolutely highest temperature was 52°·8 at Glasgow on 21st, and the lowest 10°·8 at Braemar on 11th.

The mean rainfall was 3·71 inches, or 22 per cent above the average. Dundee had more than twice its average rainfall, and nearly all eastern districts had a large excess, amounting to 85 per cent at Aberdeen, 75 at Perth, and 60 at Dunrobin, Arbroath, and Smeaton. In the extreme west and south-west rainfall was also much above the average; whilst in Nithsdale, the Clyde area, the greater part of Perthshire, and at Braemar there was a shortage, amounting to 42 per cent at Glencarron and 48 per cent at Braemar. Nearly half the East Coast rainfall was registered during the first eight days of the month, whilst in the west the wettest periods were from 12th to 16th, and from 19th to 21st.

Easterly winds were of more than average frequency, and the weather was frequently of a very wintry character, with moderate snowstorms on 6th, 7th, and 18th. Sunshine was deficient in nearly all districts, and strong gales occurred from 12th to 14th and on 20th and 21st.

MARCH.—The mean temperature was 38°·4, or 1°·0 below the mean, the days being 1°·1 and the nights 0°·9 below their means. In the counties of Dumfries and Peebles there was a deficiency of 2°·0; but one or two stations had practically an average temperature, whilst most were from 0°·5 to 1°·5 below the mean. Easterly winds, with accompanying low tempera-

tures, prevailed early in the month, and in the Edinburgh district the thermometer did not reach 40°·0 from 1st to 8th. Severe frosts also occurred on one or two days during the following week, the 1st and 15th being the coldest days of the month. From 16th to 30th comparatively high temperatures ruled, with maximum on 19th, 20th, or 23rd. The absolutely highest temperature was 59°·5 at Gordon Castle on 19th, and the lowest 13°·1 at Kingussie on 2nd.

The mean rainfall was 2·31 inches, or 19 per cent below the normal. At Aberdeen, in parts of Forfarshire, at Leith, and in the extreme south there was a moderate excess. Elsewhere there was a shortage, which was greatest at Braemar, in Inverness-shire, and along the shores of the Moray Firth. Inverness recorded less than 1 inch, the rainfall there, at Glencarron, at Fearn, and in the counties of Nairn, Elgin, and Banff being less than two-fifths of the average. A large part of the East Coast rainfall was registered early in the month, the wettest periods in the west being from 16th to 22nd and from 28th to 31st.

The weather was frequently unsettled, but no well-developed gales occurred. Early in the month moderate falls of snow, sleet, and hail were frequent in eastern districts. Sunshine was deficient in the east, but above the average towards N.W.

April.—The mean temperature was 45°·1, or 0°·9 above the mean, the days being 0°·6 and the nights 1°·3 above their means. In Sutherlandshire, the Western Islands, and the extreme south-west, temperature was slightly below the average, but elsewhere there was an excess; greater in the east than in the west, and in Mid-Lothian 2°·0. The first ten days of the month were very cold, but thereafter, except about 21st, temperature was above the average, the 19th being in most districts the warmest day of the month. Lowest readings occurred on 1st and 21st, but at about half the stations frost in shade did not occur. The absolutely highest temperature was 67°·5 at Dumfries on 19th, and the lowest 23°·3 at Braemar on 1st.

The mean rainfall was 3·95 inches, or 78 per cent above the average, the month being the wettest April since 1867. In Wigtownshire, and at most places on the East Coast, there was a shortage, Smeaton and Cupar having only half the average. Elsewhere there was an excess, the rainfall in some districts being abnormally large. Thus Invergarry had four times, and Glenquoich and Fort Augustus thrice their normal amounts; the rest of Inverness-shire and Sutherland from two to three times the average; and the counties of Fife and Linlithgow, the drainage area of the Clyde, and parts of Perthshire at least double their usual rainfalls. More than half the rain fell during the

first ten days of the month, the last week also being wet in most districts, whilst Fort William and Stronvar had only two rainless days. The largest rainfalls were 17·86 inches at Glenquoich and 13·29 inches at Glencarron.

During the first ten days the wind was from S.W., and the weather very stormy, especially in the west, with snow, sleet, and hail in places on two or three days. Again on 24th and 25th there was a gale from W. and N.W.

Sunshine was about the average in most districts, but above it in S.E. and around Inverness, and much below it at Fort Augustus and Fort William. Thunder occurred in Central Perthshire on 13th, and here and there on other days.

MAY.—The mean temperature was 48°·5, or 0°·5 below the average, the days being 1°·2 colder and the nights 0°·3 warmer than usual. In most districts temperature was within half a degree of the average, but at Fort Augustus there was a defect of 2°·0. The weather was very cold during the first twelve days, with frost in several districts on 3rd and 11th. Thereafter higher temperatures prevailed, except about 20th and 24th, the last few days of the month being very warm. The absolutely highest temperature was 77°·0 at Kingussie on 30th, and the lowest 27°·0 at Lednathie on 12th.

The mean rainfall was 3·00 inches, or nearly a third more than the average. Except at a few places in north and extreme south—such as Dunrobin, Fearn, and Dumfries—there was on the whole a decided excess, though the variations were rather irregular. Thus Invergarry had more than twice its usual rainfall, and in southern Inverness-shire generally, as in Mid- and East Lothian, there was an excess of 60 to 80 per cent. On the other hand, a good many stations had an excess of less than 15 per cent. The rainiest times of the month were from 1st to 9th, from 12th to 18th, and from 23rd to 27th. Fort William reported 1·18 inch on 1st; and heavy falls occurred at many places on 1st, 5th, and 8th.

Bright sunshine was much below the average in most districts, and during the first ten days the weather was very unsettled and of a wintry character, with snow, sleet, and hail. Thunderstorms occurred at Fort William on 1st, 13th, and 26th, and at various places on one or more days.

JUNE.—The mean temperature was 54°·3, or 0°·6 below the average, both days and nights being alike colder than usual. There was a considerable excess of winds from east and northeast, and at several East Coast places the mean for the month was more than 1°·0 below the average, the maximum at Montrose and Arbroath being below 70°·0, and Edinburgh reporting a

reading of 70°·0 only on 30th. Early in the month warm weather was experienced in the west, whilst the coldest periods were from 10th to 12th, and from 26th to 28th. During the latter period injurious ground frosts occurred in the north.

The mean rainfall was 1·96 inch, or about three-quarters of the average, the month being the driest June since 1891. In Mid- and East Lothian, in Perthshire, and in parts of the counties of Roxburgh, Perth, and Inverness the rainfall was somewhat above the average, but in nearly all other districts it was decidedly below. Dundee and Montrose had barely one quarter of their average amounts, and many eastern places to the north of the Forth only about one-half. From 2nd to 11th and from 27th to 29th practically no rain fell, the heaviest falls of the month occurring on 1st, 14th, 16th, and 24th. Glencarron registered 2·31 inches on 16th, and at many places the aggregate for the month was largely accounted for by one or two heavy daily amounts. Thus in Berwickshire fully half the total was registered on 24th, whilst at Inverness a fall of 0·71 inch on 1st was about half the total there.

The weather from the 15th to 17th was stormy, and on 24th, 25th, and 26th thunder occurred at Drumlanrig, and at a few places on some one of these days.

The month proved a remarkably sunny one in the west of Scotland, though only about the average amount of sunshine was registered in the east. Early in the month dry north-easterly winds prevailed, with cloudy skies on the east coast, but almost uninterrupted sunshine on the west. During the week ending 11th Fort William averaged 14 hours of "bright sunshine" a-day, and appears to have been the sunniest of the recording stations in the British Isles.

JULY.—The mean temperature was 57°·3, or 0·1 above the normal, both days and nights being of about average temperature. Winds from east and north-east were more frequent than usual, and in consequence easterly places north of the Tay had mostly temperatures below the average. In most other districts there was a slight or moderate excess. In the east generally there was a complete absence of hot weather, the thermometer at Leith reaching 70°·0 only on 13th and 29th, and remaining below 60°·0 from 23rd to 28th. The month was much warmer in the west and south, temperatures of 80°·0 or over being reported from Rothesay, Dumfries, and other stations on 11th. Lowest temperatures were noted on 4th, 7th, or 18th, Braemar reporting ground frosts on 4th and 18th. The absolutely highest temperature was 84°·7 at Dumfries on 11th, and the lowest 35°·0 at Lairg on 8th.

The mean rainfall was 2·11 inches, being two-thirds of the average. One or two places had a trifling excess, but most eastern and northern districts had less than half their normal amounts, and over the country generally there was a decided shortage. Several aggregates of less than 1 inch were reported, as at Inverness and Arbroath. Hardly any rain fell from 7th to 11th, from 17th to 19th, and from 24th to 30th. From 1st to 6th the weather was unsettled and wet, and on the 16th rivers in the south were in high flood as a result of heavy rains on the preceding day, when Cargen registered 1·78 inch, Leadhills 1·63, and Dumfries 1·40, or fully half its total for the month.

Thunderstorms occurred in Central Forfarshire on 2nd, 13th, 22nd, and 31st, and in most districts on one or more of these days.

Sunshine was below the average on the East Coast, but most western districts had a larger excess.

AUGUST.—The mean temperature was 56°·0, or 0·6 below the average, the nights being distinctly colder than usual. Temperature was above the average in Fifeshire and Mid-Lothian, but in most districts slightly, and at Cally, Fort Augustus, and Peterhead decidedly below. Warm weather was experienced at the beginning and end of the month, but from 5th to 27th the weather became steadily colder, with lowest readings on 21st and 25th, and ground frosts, and even frost in shade, in the north on the latter date. The mean temperature of the fourth week was from 3°·0 to 4°·0 below the average. Highest temperatures occurred on 3rd and 4th and between 28th and 30th, the absolutely highest reported being 84°·5 at Tillypronie on 28th, and the next highest 79°·0 at Broomlands on 30th, and at Dumfries on 3rd and 29th. The lowest temperature was 31°·2 at Kingussie on 25th.

The mean rainfall was 4·58 inches, or 27 per cent above the average. Aberdeen had less than three-quarters of its usual amount, and at a few places the rainfall differed but little from the average; but in general there was a decided excess, which was more than 50 per cent in the counties of Edinburgh, East Lothian, and Forfar. The number of rainy days was large, Glencarron having twenty-eight, and a large number of places had falls of more than an inch on some one day—*e.g.*, Dundee, 1·40 inch on 4th; Leadhills, 1·61 on 6th; Rothesay, 1·27 on 10th; Leith, 1·29 on 11th; Stronvar, 1·26 on 13th; Fort William, 1·52 on 14th; and Edinburgh, 1·15 on 17th. The rainiest periods were from 4th to 7th and from 9th to 18th, heavy falls occurring in the west on the 1st also. From 27th to 30th hardly any rain fell in eastern and southern districts.

A thunderstorm was general on the East Coast on the 6th, and thunder was somewhat frequent in East Lothian and Berwickshire.

Sunshine was above the average in the west, but only the usual amount, or rather less, was registered in eastern districts.

SEPTEMBER.—The mean temperature was 52°·9 or 0°·1 above the average, the days being a little warmer and the nights a little colder than usual. In most districts the month was of about average temperature, but slightly below at most eastern stations (though above it in Mid-Lothian), and decidedly above towards the north-west. No very notable variations occurred, the warmest days and coldest nights at most places both falling between the 14th and 22nd, when the barometer remained continuously at a somewhat high level. Frost occurred at hill stations towards the north about 14th, 21st, and 28th, and at Drumlanrig, in the Nith Valley, on 21st. The absolutely highest temperature was 72°·6 at Lairg on 19th, and the lowest 29°·1 at Kingussie on 14th.

The mean rainfall was 3·15 inches, or 13 per cent below the average. At Fort William, in Central Perthshire, and in the counties of Stirling, Dumbarton, Renfrew, Bute, and Wigtown rainfall was more or less above the average; but elsewhere there was a decided shortage, East Lothian and the Border counties having less than half the average amount. The number of rainy days was unusually small, the notable feature of the month being that the rainfall at most stations was largely made up by heavy falls on one or more days. Fort William reported 1·45 inch on 4th and 1·98 on 5th; Greenock had falls of 1 inch or over on 2nd, 5th, and 29th, whilst at Edinburgh more than half the total for the month was registered on 24th and 25th The first few days were very wet, and on the 6th the Perthshire rivers were in full flood, Stronvar having an aggregate of about 3½ inches for the two preceding days. Hardly any rain fell from 13th to 23rd, except in some central and western districts on 16th or 17th.

The weather was stormy on 4th and 5th; and thunder was heard at Glencarron on 3rd, at Paisley on 6th, and at Buchlyvie on 16th.

The second and third weeks were very sunny, the amount of sunshine for the month being decidedly above the average.

OCTOBER.—The mean temperature was 48°·0, or 1°·5 above the average, both days and nights being much warmer than usual, and the excess in nearly all districts very decided. The first two weeks of the month were hardly of average temperature, but the third and fourth were much warmer than

usual. At the very end of the month easterly winds prevailed, with much colder weather. The coldest night was, in most districts, that of the 12th, frost being then of general occurrence. The warmest days were between 3rd and 5th and between 18th and 21st. The absolutely highest temperature was 67°·5 at Tillypronie on 18th, and the lowest 22°·6 at Braemar on the night of the 12th.

The mean rainfall was 2·02 inches, or only half the average, the month being, on the whole, the driest October since at least 1879, and at many places the driest as yet recorded. In the eastern counties rainfall was much less than half the average, and Aberdeen, Montrose, Edinburgh, and Duns had only one quarter of their usual amounts. Towards the west the shortage was relatively less, though ranging at many stations from 40 to 50 per cent. The rainiest days of the month were 5th, 6th, and, in the west, 16th, the heaviest falls occurring on 5th, the amount for that day at Aberdeen and Dundee accounting for half the totals for the month at these places. On the East Coast there were very few rainy days, Smeaton having only six and Edinburgh only eight.

The weather was unsettled early in the month, with a gale from south-west on 5th. Somewhat stormy weather occurred also on 16th. Snow, sleet, or hail fell in northerly districts on 7th or 8th.

The month was extremely sunny, especially towards the south-east.

NOVEMBER.—The mean temperature was 40°·8, or 0°·1 below the average, the days and nights being of about average temperature. In northern districts the month proved colder than usual, and at most southern places somewhat warmer; but at a good many stations temperature differed but little from the average. The month was divided into well-defined warm and cold spells. Thus from 1st to 19th, under the influence of W. and S.W. winds, the weather was extremely mild; from 20th to 26th N.W. winds prevailed, with extremely low temperatures for November; whilst at the end of the month the weather was again mild. The contrast between the week ending 19th and that ending 26th was remarkable: the former week was fully 5°·0 warmer than usual, whilst during the latter the thermometer fell, on the 22nd, to zero at Kingussie and to 7°·0 at Stronvar, and, on the 26th, to 7°·3 at Braemar and to 10°·0 at Stobo. During this notable cold spell temperature did not rise to 40°·0 at many stations, and was, as a rule, fully 7°·0 below the average. The absolutely highest temperature was 64°·0 at Cupar and Balruddery on 3rd, and the lowest –0°·4 at Kingussie on 22nd.

The mean rainfall was 2·31 inches, or only three-fifths of the average. In Lewis and Arran, and in the extreme south-west, rainfall was above or just about the average; but over the country generally there was a decided shortage. In the eastern counties, Lednathie, Perth, and Cupar had hardly one-fifth of their usual amounts; several other stations reported less than 1 inch for the month, and in general much less than half the average rainfall was recorded. The deficiency was as a rule less towards the west and much less towards the north, the Clyde area having about three-fifths and the extreme northerly counties about four-fifths of their normal rainfalls. In the upper Nith Valley, in Central Perthshire, and at Fort Augustus the shortage was as marked as on the East Coast. Between 7th and 9th heavy rains were general, Dunoon and Bowhill (Ayrshire) reporting amounts of 2 inches or over on 8th, and on 10th the Doon and other southern rivers were in high flood. In eastern districts hardly any rain fell from 1st to 5th and from 11th to 19th, whilst the wettest periods after the 9th were from 16th to 20th in west and from 21st to 23rd in north and east.

A snowstorm was general between 21st and 24th, and the weather was stormy between 7th to 10th and during the cold week from 20th to 26th. Thunder was reported at Gordon Castle and Broomlands on 23rd and at Smeaton on 24th.

Sunshine was rather above the average in all districts; but towards the end of the month a good deal of fog occurred.

December.—The mean temperature was 38°·6 or 0°·6 above the normal, the days and nights both being a little warmer than usual. The month was rather colder than usual in the south, in parts of Perthshire, and at Dundee and Aberdeen, but in most districts it was somewhat warmer. A good deal of mild weather was experienced during the month, with high temperatures about 4th, 17th, or 29th. From 7th to 14th an exceedingly cold spell occurred, with lowest readings on the night of 10th, when the thermometer fell to 10°·0 or under on the Grampians and on the hills of Forfarshire and Perthshire. In the south it was again very cold on 26th and 27th. The absolutely highest temperature was 57°·6 at Corstorphine on 5th, and the lowest 6°·0 at Braemar on night of 10th.

The mean rainfall was 3·59 inches, or 14 per cent below the average. Rainfall was decidedly above the average in Lewis, the Northern Islands, Banffshire, and at Dollar, Stronvar, and Fort Augustus; somewhat above in Mid-Lothian and at Poltalloch; and about the average at Glencarron and Nairn. Elsewhere there was a deficiency, Upper Teviotdale having only half the average, and Braemar, Arbroath, and Cally only about three-fifths. From 18th to 27th but little rain fell, the

rainiest periods being from 1st to 6th, from 11th to 17th, and 28th and 29th. On the 17th Leadhills had a fall of 2·09 inches, and on 29th Glencarron registered 2·38 inches.

Gales occurred on 4th and 5th, on 12th, and on 29th and 30th, the first half of the month being very unsettled. Between 7th and 12th a snowstorm was more or less general, and from 20th to 27th there was much fog in the south, the weather in England being very foggy at that time. Thunder occurred at Paisley on 30th.

The month was on the whole rather sunnier than usual.

The weather conditions in early autumn were peculiarly favourable for the ingathering of crops, and the harvest of 1904 was in nearly all districts conducted from start to finish with hardly any interruption and with unusual quickness. Everywhere crops were cut much earlier than in 1903—an unusually late and unsatisfactory year—but over the country generally harvest began rather later than the average, though earlier in north-eastern districts.

As regards cereals, *wheat*, *barley*, and *oats* gave a satisfactory yield in practically all districts. Straw, however, was generally very short.

*Potatoes* were almost everywhere a splendid crop, only West Lothian, Eskdale, and Annandale reporting much disease. Very heavy yields were obtained in north-eastern counties; and lifting was generally effected in most favourable weather.

*Turnips*, also, were in most districts an excellent crop, and resowing was hardly anywhere necessary.

The most notable feature of the weather of the year was the continued deficiency of rainfall from September to December, whilst April was the only month with a rainfall conspicuously above the average. The year offered a remarkable contrast to its very wet predecessor, and taking the country as a whole 1904 can have had little more than two-thirds as much rain as 1903.

AGRICULTURAL STATISTICS.—Returned upon 4th June 1904.—(*Compiled from the Government Returns.*)

Table No. 1.—Acreage under each kind of Crop, Bare Fallow, and Grass, in each County of Scotland.

| Counties. | Total Acreage under Crops, Bare Fallow, and Grass. | Corn Crops | | | | | | | Green Crops. | | | | | | | Clover, Sainfoin, and Grasses under Rotation. | Permanent Pasture (exclusive of Mountain Land) | Flax. | Small Fruit. | Bare Fallow or Uncropped Arable Land. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wheat. | Barley or Bere. | Oats. | Rye | Beans. | Peas. | Total. | Potatoes. | Turnips. | Mangels. | Cabbage, Kohl-rabi and Rape | Vetches or Tares | Other Green Crops. | Total. | | | | | |
| | Acres. | Acres | Acres. | Acres. | Acres | Acres. | Acres | Acres | Acres. | Acres | Acres | Acres | Acres | Acres | Acres | Acres | Acres. | Acres. | Acres | Acres. |
| 1. Aberdeen | 630,530 | | 17,741 | 193,270 | 160 | 51 | 57 | 211,280 | 7,391 | 88,805 | 2 | 196 | 2,492 | 315 | 99,201 | 286,259 | 32,578 | .. | 309 | 266 |
| 2. Argyll | 136,018 | . | 1,318 | 17,669 | 524 | 101 | 2 | 19,614 | 4,272 | 5,551 | 42 | 230 | 19 | 66 | 10,180 | 26,834 | 79,135 | .. | 39 | 216 |
| 3. Ayr | 320,914 | 560 | 873 | 44,992 | 93 | 720 | 12 | 47,250 | 9,457 | 6,538 | 606 | 732 | 30 | 202 | 17,565 | 94,988 | 160,836 | .. | 157 | 107 |
| 4. Banff | 160,021 | | 7,826 | 49,316 | 53 | 105 | 30 | 57,330 | 2,102 | 21,871 | 6 | 15 | 904 | 8 | 24,906 | 68,154 | 9,524 | .. | 14 | 57 |
| 5. Berwick | 192,053 | 1,375 | 19,600 | 32,975 | 30 | 837 | 4 | 54,821 | 2,404 | 26,410 | 273 | 724 | 529 | 5 | 30,345 | 59,330 | 47,451 | .. | 31 | 75 |
| 6. Bute | 25,928 | . | 35 | 4,734 | 96 | 53 | 4 | 4,922 | 974 | 1,369 | 8 | 84 | 3 | 54 | 2,492 | 9,111 | 9,140 | .. | 64 | 199 |
| 7. Caithness | 112,064 | .. | 868 | 33,608 | 111 | 18 | 27 | 34,627 | 1,686 | 13,315 | 4 | 43 | 384 | 3 | 15,435 | 34,417 | 27,445 | .. | 9 | 131 |
| 8. Clackmannan | 15,281 | 116 | 424 | 3,465 | 4 | 428 | | 4,437 | 424 | 794 | 5 | 66 | 11 | 1 | 1,301 | 3,209 | 6,151 | .. | 13 | 170 |
| 9. Dumbarton | 51,283 | 675 | 181 | 7,046 | 11 | 119 | 4 | 8,036 | 2,549 | 1,374 | 33 | 249 | 34 | 13 | 4,252 | 17,559 | 21,281 | .. | 57 | 98 |
| 10. Dumfries | 259,901 | 68 | 648 | 41,553 | 18 | 1 | 4 | 42,292 | 3,655 | 17,046 | 469 | 1,195 | 36 | 49 | 22,450 | 84,343 | 110,076 | .. | 71 | 69 |
| 11. Edinburgh | 129,807 | 4,560 | 4,304 | 23,163 | 17 | 85 | 134 | 32,263 | 6,711 | 10,785 | 49 | 1,345 | 251 | 387 | 19,528 | 33,917 | 43,788 | .. | 267 | 44 |
| 12. Elgin | 101,048 | 526 | 12,386 | 22,466 | 398 | 35 | 27 | 35,838 | 1,993 | 15 140 | 39 | 38 | 334 | 17 | 17,561 | 38,266 | 9,203 | 1 | 23 | 156 |
| 13. Fife | 254,634 | 8,494 | 20,159 | 40,927 | 868 | 1,069 | 25 | 71,542 | 15,831 | 23,421 | 64 | 525 | 679 | 68 | 40,588 | 63,620 | 78,024 | 7 | 198 | 655 |
| 14. Forfar | 249,940 | 6,312 | 27,991 | 51,139 | 552 | 371 | 26 | 86,391 | 13,305 | 33,230 | 77 | 321 | 890 | 120 | 47,443 | 89,159 | 26,648 | 1 | 274 | 24 |
| 15. Haddington | 112,026 | 4,467 | 15,397 | 17,302 | 4 | 341 | 93 | 37,604 | 9,041 | 15,192 | 298 | 621 | 187 | 257 | 25,596 | 26,927 | 21,450 | .. | 369 | 80 |
| 16. Inverness | 148,892 | 11 | 6,827 | 30,275 | 633 | 15 | 10 | 37,771 | 6,001 | 10,750 | 20 | 52 | 100 | 11 | 16,934 | 30,354 | 63,292 | .. | 33 | 508 |
| 17. Kincardine | 119,969 | 218 | 10,969 | 29,696 | 22 | 377 | 22 | 41,324 | 2,510 | 17,598 | 1 | 37 | 390 | 120 | 20,656 | 49,009 | 8,859 | .. | 84 | 36 |
| 18. Kinross | 35,354 | 5 | 275 | 6,610 | 60 | 17 | | 6,967 | 713 | 2,715 | 3 | 131 | 51 | | 3,613 | 11,688 | 13,040 | .. | 23 | 23 |
| 19. Kirkcudbright | 192,081 | 36 | 55 | 26,149 | 3 | 33 | 2 | 26,278 | 1,569 | 11,440 | 117 | 1,247 | 15 | 40 | 14,428 | 65,354 | 85,953 | .. | 30 | 38 |
| 20. Lanark | 255,786 | 1,553 | 255 | 37,151 | 87 | 472 | 20 | 39,538 | 4,645 | 9,498 | 45 | 2,105 | 195 | 365 | 16,853 | 80,721 | 116,344 | .. | 1,922 | 408 |
| 21. Linlithgow | 58,392 | 1,258 | 2,818 | 10,191 | 6 | 227 | 5 | 14,505 | 2,248 | 3,544 | 33 | 331 | 137 | 23 | 6,316 | 14,190 | 23,235 | .. | 44 | 102 |
| 22. Nairn | 25,762 | .. | 3,286 | 5,505 | 50 | | 2 | 8,853 | 338 | 4,135 | 13 | 11 | 32 | 2 | 4,531 | 10,310 | 2,025 | .. | 4 | 39 |
| 23. Orkney | 107,665 | . | 4,671 | 33,357 | 2 | .. | . | 38,030 | 2,733 | 14,494 | .. | 47 | 306 | 13 | 17,593 | 34,037 | 17,729 | .. | | 246 |
| 24. Shetland | 58,152 | | 1,513 | 7,826 | 40 | | | 9,379 | 2,872 | 1,468 | .. | 719 | 2 | . | 5,061 | 1,578 | 41,774 | . | .. | 360 |
| 25. Peebles | 49,877 | | 337 | 7,660 | 30 | | 3 | 8,030 | 329 | 3,889 | 5 | 685 | 28 | | 4,936 | 21,648 | 15,224 | .. | 22 | 17 |
| 26. Perth | 336,251 | 4,007 | 11,712 | 68,281 | 453 | 1,847 | 14 | 86,314 | 13,678 | 28,193 | 73 | 623 | 305 | 138 | 43,010 | 103,666 | 100,512 | .. | 1,646 | 1,103 |
| 27. Renfrew | 91,251 | 1,107 | 70 | 11,029 | 21 | 184 | | 12,411 | 3,172 | 2,219 | 61 | 393 | 28 | 58 | 5,931 | 24,083 | 48,566 | .. | 115 | 137 |
| 28. Ross & Cromarty | 141,315 | 539 | 11,667 | 31,192 | 484 | 1 | 7 | 43,890 | 7,301 | 15,487 | 113 | 319 | 472 | 13 | 23,606 | 42,659 | 30,752 | .. | 85 | 283 |
| 29. Roxburgh | 182,855 | 368 | 12,024 | 28,072 | 39 | 325 | 14 | 40,842 | 1,292 | 20,662 | 95 | 823 | 251 | 57 | 23,180 | 49,688 | 69,049 | . | 67 | 29 |
| 30. Selkirk | 29,877 | | 193 | 4,710 | | | | 4,903 | 200 | 2,568 | 3 | 155 | 39 | 1 | 2,966 | 9,228 | 12,769 | .. | 9 | 2 |
| 31. Stirling | 116,284 | 1,309 | 2,633 | 18,766 | 67 | 2,543 | 5 | 25,323 | 3,212 | 4,258 | 29 | 314 | 150 | 119 | 8,082 | 29,895 | 51,859 | .. | 129 | 996 |
| 32. Sutherland | 32,574 | | 1,074 | 8,241 | 76 | 6 | 4 | 9,401 | 1,618 | 3,036 | | 40 | 36 | | 4,730 | 9,258 | 9,043 | .. | 1 | 141 |
| 33. Wigtown | 154,853 | 158 | 614 | 32,408 | 16 | 134 | 8 | 33,338 | 1,509 | 14,926 | 383 | 302 | 52 | 56 | 17,228 | 67,298 | 36,819 | .. | 13 | 157 |
| Total | 4,888,63 | 37,722 | 200,764 | 980,739 | 5,028 | 10,515 | 575 | 1,235,343 | 137,735 | 451,721 | 2,969 | 14,709 | 8,872 | 2,581 | 618,587 | 1,590,757 | 1,430,174 | 9 | 6,072 | 6,972 |

TABLE No. 2.—ESTIMATED TOTAL PRODUCE OF WHEAT, BARLEY, AND OATS, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1903, compared with the Estimated YIELD for the Years 1902 and 1901, and the AVERAGE of the Ten Years, 1892-1901, in each COUNTY of SCOTLAND.

| COUNTIES | WHEAT | | | | | | BARLEY, INCLUDING BERE | | | | | | OATS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Produce in 1903 | Acreage in 1903. | Average Yield per Acre 1903 | 1902 | 1901 | Average of the Ten Years, 1893-1902 | Total Produce in 1903 | Acreage in 1903 | Average Yield per Acre 1903. | 1902. | 1901 | Average of the Ten Years, 1893-1902 | Total Produce in 1903 | Acreage in 1903 | Average Yield per Acre 1903 | 1902. | 1901 | Average of the Ten Years, 1893-1902. |
| | Bush | Acres | Bush | Bush. | Bush | Bush | Bush. | Acres | Bush | Bush | Bush. | Bush. | Bush | Acres | Bush | Bush | Bush. | Bush |
| Aberdeen | 64 | 2 | 32 00 | 30.00 | 25 60 | *30 04 | 694,606 | 22,041 | 31 51 | 30 50 | 33 18 | 34 23 | 6,706,733 | 189 853 | 35 33 | 34 14 | 34 82 | 35 29 |
| Argyll | | | | 37 00 | 43 00 | | 41,275 | 1,423 | 29 01 | 27 40 | 27 11 | 31.22 | 524,116 | 17,491 | 29 96 | 31 82 | 31 15 | 30 88 |
| Ayr | 30,176 | 787 | 38 34 | 40 99 | 40 67 | 38 22 | 35,153 | 959 | 36 66 | 40 72 | 41 28 | 39 96 | 1,926,935 | 45,407 | 42 44 | 48 83 | 47 04 | 45.86 |
| Banff | 160 | 5 | 32 00 | 36 36 | 32 73 | 33 16 | 291,524 | 8,614 | 33 84 | 31 98 | 34.23 | 35 47 | 1,856,541 | 49,050 | 37 85 | 36 15 | 35 63 | 36 61 |
| Berwick | 67,082 | 1,871 | 35 85 | 36.93 | 35 36 | 34 47 | 712,985 | 19,606 | 36 37 | 37 16 | 37 28 | 35 90 | 1,330,252 | 33,134 | 40 15 | 39 55 | 39 25 | 37 40 |
| Bute | | | | | 32 00 | | 1,260 | 37 | 34 05 | 39 92 | 41.37 | 40 33 | 178,525 | 4,833 | 36 94 | 32 13 | 35 00 | 34.85 |
| Caithness | 6 | 1 | 6 00 | | 16 00 | †15 11 | 25,626 | 1,006 | 25 47 | 31 52 | 26 12 | 30 40 | 860,390 | 33,374 | 25 78 | 31 85 | 28.83 | 31 65 |
| Clackmannan | 8,301 | 225 | 36 89 | 39 14 | 38 90 | 38 63 | 15,529 | 513 | 30 27 | 37 73 | 32 40 | 35 27 | 126,447 | 3,379 | 37 42 | 42 57 | 40 54 | 42 12 |
| Dumbarton | 26,932 | 798 | 33 75 | 38 04 | 42 97 | 39 43 | 5,441 | 174 | 31 27 | 37 39 | 41 77 | 42 11 | 241,707 | 7,123 | 33 93 | 41 19 | 41 44 | 41 74 |
| Dumfries | 2,775 | 75 | 37 00 | 38 63 | 40 70 | 38 09 | 20,062 | 563 | 35 63 | 35 56 | 40 15 | 35 82 | 1,342,659 | 41,557 | 32 31 | 35 87 | 36 62 | 33.88 |
| Edinburgh | 191,671 | 4,405 | 43.51 | 45 35 | 44 52 | 44 44 | 221,067 | 5,129 | 43 10 | 45 12 | 46 62 | 44 42 | 993,179 | 23,061 | 43 07 | 43 61 | 45 74 | 42.81 |
| Elgin or Moray | 26,803 | 711 | 37.70 | 37 32 | 36 74 | 37 18 | 430,073 | 12,650 | 34 00 | 35.22 | 30 33 | 34.52 | 867,835 | 22,150 | 39 18 | 39.88 | 35 96 | 37 27 |
| Fife | 301,706 | 9,043 | 33 36 | 36 83 | 36 75 | 35 47 | 819,618 | 21,299 | 38 48 | 36 25 | 41.50 | 35 60 | 1,681,336 | 39,814 | 42 23 | 43 45 | 46 60 | 39.61 |
| Forfar | 208,406 | 6,375 | 32.69 | 34 76 | 39 74 | 36 06 | 1,131,982 | 29,429 | 38 46 | 40 06 | 41 45 | 37 46 | 2,405,239 | 50,182 | 47 93 | 48.21 | 49 10 | 44 39 |
| Haddington | 187,546 | 4,652 | 40.32 | 41 83 | 40 43 | 39 86 | 621,144 | 15,835 | 39 23 | 42 74 | 41 77 | 42 03 | 756,382 | 17,432 | 43 39 | 46 85 | 43 99 | 44 36 |
| Inverness | 149 | 6 | 24 83 | 24 00 | 21 95 | 29 57 | 147,764 | 6,666 | 22 17 | 24 13 | 23 14 | 29 78 | 805,626 | 30,702 | 26 24 | 25 48 | 28 25 | 30.21 |
| Kincardine | 10,969 | 316 | 34 71 | 35 12 | 36 71 | 36 65 | 418,476 | 12,749 | 32 82 | 33 33 | 35 39 | 36 07 | 1,100,606 | 28,376 | 38 79 | 39 75 | 40 61 | 40 07 |
| Kinross | 150 | 5 | 30.00 | 36 82 | 36 00 | ‡34 93 | 13,005 | 445 | 29 22 | 32.44 | 36.26 | 33.65 | 202,315 | 6,425 | 31.49 | 38 54 | 36.67 | 31.46 |
| Kirkcudbright | 2,608 | 83 | 31 42 | 34 80 | 38 64 | 34 12 | 3,854 | 121 | 31 85 | 38 07 | 34 00 | 33 95 | 929,382 | 26,244 | 35 41 | 37.63 | 37 34 | 34.22 |
| Lanark | 62,823 | 2,005 | 31.33 | 34 52 | 40 91 | 36 38 | 10,974 | 373 | 29 42 | 30 33 | 35.84 | 33 63 | 1,262,496 | 37,131 | 34 00 | 34 44 | 40 19 | 36 38 |
| Linlithgow | 61,109 | 1,416 | 43 16 | 41 79 | 40 72 | 40 75 | 135,743 | 3,113 | 43 61 | 44 34 | 47 56 | 44.07 | 430,820 | 9,861 | 43.69 | 45.07 | 44 07 | 43 09 |
| Nairn | | | | | | ‡32 35 | 95,513 | 3,085 | 30 96 | 32.35 | 25 72 | 32 91 | 208,641 | 5,736 | 36 25 | 37 22 | 33 80 | 35 62 |
| Orkney | | | | | | | 148,909 | 4,494 | 33 14 | 33 00 | 33 81 | 33 33 | 916,975 | 33,574 | 27 31 | 28 23 | 28 95 | 28 84 |
| Peebles | 512 | 16 | 32 00 | 32 00 | 34 00 | 31 30 | 13,713 | 421 | 32 57 | 37 56 | 38.31 | 34 20 | 260,001 | 7,660 | 33 94 | 37.20 | 35 32 | 34 00 |
| Perth | 148,353 | 4,219 | 35 16 | 39 12 | 40 23 | 38 34 | 494,541 | 13,132 | 37 66 | 38 06 | 37 45 | 35 24 | 2,633,306 | 67,456 | 39 04 | 40.46 | 37.45 | 35 67 |
| Renfrew | 52,750 | 1,334 | 39 54 | 41 02 | 40 96 | 40 35 | 4,391 | 102 | 43 05 | 42 05 | 42 30 | 42 12 | 425,351 | 11,124 | 38 24 | 44.50 | 44 42 | 43 43 |
| Ross and Cromarty | 16,167 | 553 | 29 24 | 30 37 | 27.96 | 36 86 | 340,136 | 11,384 | 29.88 | 32 46 | 29 91 | 36 18 | 966,441 | 31,234 | 30 94 | 33.07 | 29.65 | 36 58 |
| Roxburgh | 12,529 | 380 | 32 97 | 30 16 | 29 53 | 31 60 | 428,271 | 12,201 | 35.10 | 33.85 | 34 94 | 34 41 | 1,002,534 | 27,973 | 35.84 | 38.52 | 38 96 | 35.30 |
| Selkirk | 240 | 8 | 30 00 | 25 00 | | *29 17 | 5,450 | 201 | 27 11 | 24 00 | 29 33 | 28 96 | 171,640 | 4,904 | 35.00 | 32.00 | 36 28 | 33 34 |
| Shetland | | | | | | | 34,249 | 1,530 | 22 38 | 20 84 | 24 61 | 25 61 | 193,121 | 7,908 | 24.42 | 21.78 | 23.44 | 26.27 |
| Stirling | 54,792 | 1,622 | 33 78 | 37 22 | 36 84 | 36 77 | 91,723 | 2,865 | 32.02 | 37 65 | 34 32 | 35.67 | 675,170 | 18,322 | 36 85 | 40 82 | 39.83 | 39.79 |
| Sutherland | 75 | 3 | 25 00 | | | | 25,719 | 1,163 | 22.11 | 26 90 | 22.43 | 28.70 | 192,448 | 8,119 | 23 70 | 27.78 | 23 54 | 27 78 |
| Wigtown | 6,404 | 215 | 29 79 | 27.52 | 29 26 | 28 05 | 22,702 | 727 | 31.23 | 29 68 | 32.96 | 31.63 | 1,092,549 | 32,501 | 33.62 | 33.26 | 34 34 | 34.19 |
| Total | 1,481,258 | 41,131 | 36.01 | 38 07 | 39.15 | 37.64 | 7,502,478 | 214,050 | 35 05 | 35.52 | 36 30 | 35.90 | 35,267,698 | 973,110 | 36.24 | 37.34 | 37.38 | 36.64 |

* Average of 6 years only. † Average for 7 years. ‡ Average of 8 years only.

TABLE No. 3.—ESTIMATED TOTAL PRODUCE OF BEANS, PEAS, AND POTATOES, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1903, compared with the Estimated YIELD for the Years 1902 and 1901, and the AVERAGE of the Ten Years, 1893-1902, in each COUNTY of SCOTLAND.

| COUNTIES. | BEANS. | | | | | | PEAS. | | | | | | POTATOES. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Produce in 1903. | Acreage in 1903. | Average Yield per Acre | | | Average of the Ten Years, 1893-1902 | Total Produce in 1903. | Acreage in 1903. | Average Yield per Acre. | | | Average of the Ten Years, 1893-1902. | Total Produce in 1903. | Acreage in 1903. | Average Yield per Acre | | | Average of the Ten Years, 1893-1902. |
| | | | 1903 | 1902. | 1901. | | | | 1903. | 1902 | 1901. | | | | 1903. | 1902. | 1901. | |
| | Bush | Acres. | Bush. | Bush. | Bush | Bush | Bush | Acres. | Bush. | Bush. | Bush. | Bush. | Tons. | Acres. | Tons. | Tons. | Tons. | Tons. |
| Aberdeen | 1,361 | 52 | 26.17 | 29 72 | 30 34 | 26 04 | 873 | 44 | 19 84 | 18 69 | 26 97 | 22 72 | 32,191 | 7,311 | 4.40 | 3.90 | 4.96 | 5.07 |
| Argyll | 2,517 | 111 | 22.68 | 22.78 | 18 18 | 19.00 | 94 | 6 | 15 67 | 20 67 | 22.40 | 19 72 | 22,866 | 4,330 | 5 28 | 4.74 | 5.26 | 4.73 |
| Ayr | 25,645 | 862 | 29.75 | 33 38 | 36 04 | 34 45 | 321 | 10 | 32.10 | 34 68 | 34 53 | 34.35 | 64,691 | 8,928 | 7.25 | 8.58 | 7 57 | 6.84 |
| Banff | 1,789 | 101 | 17.71 | 24.56 | 29 96 | 25 83 | 613 | 35 | 17.51 | 23.11 | 23.00 | 22.17 | 11,265 | 1,983 | 5.68 | 4.86 | 6.36 | 5.87 |
| Berwick | 31,900 | 960 | 33.23 | 37 54 | 33.75 | 33 81 | 980 | 35 | 28 00 | 29 66 | 26 03 | 26 80 | 12,072 | 2,308 | 5.23 | 6.13 | 6.06 | 6 10 |
| Bute | 1,574 | 60 | 26.23 | 20 48 | 23 01 | 20 94 | 38 | 2 | 19 00 | 21.50 | 17 91 | 18 09 | 7,222 | 974 | 7.41 | 5.40 | 5.94 | 5.70 |
| Caithness | 132 | 22 | 6.00 | 7.83 | 6 50 | 7.55 | 66 | 12 | 5 50 | 5 58 | 5 62 | 10 28 | 7,741 | 1,647 | 4.70 | 6.06 | 5.73 | 5.32 |
| Clackmannan | 14,846 | 441 | 33 66 | 34 33 | 34 32 | 32 43 | .. | . | | 31 25 | . | | 3,705 | 398 | 9.31 | 8.87 | 11.63 | 9.14 |
| Dumbarton | 2,573 | 127 | 20.26 | 22 11 | 23.55 | 24 98 | 97 | 5 | 19.40 | 21 00 | 39 83 | 21 74 | 15,676 | 2,489 | 6.30 | 8.16 | 8.35 | 7 73 |
| Dumfries | 81 | 3 | 27.00 | 30 48 | 32.75 | 27.86 | 127 | 5 | 25.40 | 21 50 | 22.33 | 21 97 | 20,316 | 3,432 | 5.92 | 6.23 | 7.20 | 6.19 |
| Edinburgh | 1,865 | 59 | 31.61 | 37.52 | 36.95 | 34 56 | 3,580 | 132 | 27 12 | 28.94 | 27 72 | 26.64 | 48,743 | 6,041 | 8 07 | 8.11 | 8 80 | 7.08 |
| Elgin or Moray | 700 | 26 | 26.92 | 28.34 | 23.52 | 29 06 | 755 | 30 | 27.17 | 22.38 | 20.46 | 24 41 | 9,627 | 1,770 | 5 44 | 5 61 | 5.67 | 5.81 |
| Fife | 39,251 | 1,127 | 34.83 | 35 58 | 37 11 | 34.29 | 691 | 20 | 34 55 | 20 92 | 32 78 | 29 10 | 70,766 | 15,319 | 4.62 | 6.09 | 6.95 | 5.19 |
| Forfar | 15,571 | 509 | 30 59 | 35.64 | 36.99 | 33 60 | 2,178 | 70 | 31 11 | 28.47 | 24.62 | 27.37 | 74,603 | 12,467 | 5 98 | 6.74 | 7.20 | 5.76 |
| Haddington | 13,631 | 388 | 35 13 | 39 34 | 35.28 | 35 52 | 2,757 | 94 | 29.33 | 32.18 | 28.77 | 27.54 | 59,400 | 8,229 | 7.22 | 6.94 | 7.10 | 6.66 |
| Inverness | 416 | 26 | 16 00 | 17.44 | 16 57 | *18 38 | 229 | 14 | 16.36 | 16.41 | 17.15 | 22.03 | 23,839 | 5,977 | 3.99 | 4.16 | 4.12 | 4.00 |
| Kincardine* | 12,616 | 365 | 34.56 | 34 37 | 38 13 | 36.27 | 1,152 | 36 | 32 00 | 31 87 | 36 00 | 28 13 | 10,309 | 2,327 | 4 43 | 4 41 | 5.63 | 5.71 |
| Kinross | 840 | 35 | 24.00 | 30.00 | 36.09 | 33.44 | .. | | | 24 00 | . | †28 33 | 3,354 | 689 | 5.25 | 5.72 | 6.65 | 5.74 |
| Kirkcudbright | 992 | 32 | 31.00 | 34 97 | 32 51 | 32 04 | 89 | 4 | 22 25 | 27.33 | 31.80 | 27 90 | 8,019 | 1,441 | 5.56 | 6.49 | 6.16 | 5 85 |
| Lanark | 14,793 | 557 | 26.56 | 28 90 | 35 46 | 32.17 | 278 | 12 | 23 17 | 22 97 | 28.54 | 27.61 | 30,058 | 4,449 | 6.76 | 7.53 | 9 27 | 7.39 |
| Linlithgow | 8,091 | 254 | 31 85 | 36 04 | 35.57 | 33.51 | 56 | 2 | 28.00 | 32.13 | 30 50 | 27 29 | 16,764 | 2,143 | 7.82 | 8.14 | 8.62 | 6.98 |
| Nairn | | .. | . | | . | | 74 | 4 | 18.50 | 20 00 | 19 33 | *22 43 | 1,933 | 396 | 4.88 | 4.94 | 5 02 | 4.41 |
| Orkney | . | | . | | .. | | | | . | | . | .. | 13,504 | 2,737 | 4.93 | 5.87 | 5.82 | 6.78 |
| Peebles | | . | | | . | | 500 | 19 | 26 32 | 27 00 | 25.03 | 25.05 | 1,806 | 308 | 5.86 | 7 22 | 8.40 | 6.77 |
| Perth | 56,522 | 1,751 | 32 28 | 35 88 | 35.49 | 34.13 | 1,173 | 38 | 30 87 | 29.97 | 24.74 | 29 32 | 71,325 | 12,589 | 5.67 | 7.62 | 7.46 | 6.20 |
| Renfrew | 7,336 | 195 | 37 62 | 39 63 | 40.75 | 39 54 | 287 | 8 | 35 87 | 35 87 | 37 88 | 36 51 | 23,460 | 3,138 | 7.48 | 8.00 | 7.86 | 7.09 |
| Ross and Cromarty | 98 | 6 | 16.33 | 16 20 | 14.83 | 19 29 | 303 | 20 | 15.15 | 16.03 | 15.15 | 20 58 | 24,686 | 7,281 | 3.39 | 3.49 | 3 21 | 3.50 |
| Roxburgh | 12,160 | 428 | 28.41 | 33.43 | 34.43 | 31.68 | 400 | 15 | 26 67 | 30 35 | 31.00 | 28 72 | 6,782 | 1,162 | 5 84 | 5 80 | 6.76 | 5.61 |
| Selkirk | . | .. | .. | 30 00 | .. | . | 26 | 1 | 26 00 | 28 00 | 30 00 | 27.43 | 748 | 187 | 4.00 | 5 00 | 6.32 | 4.57 |
| Shetland | | | | .. | | . | | | | . | .. | .. | 8,645 | 2,841 | 3.04 | 3.58 | 4 94 | 4.09 |
| Stirling | 76,455 | 2,480 | 30 83 | 32 99 | 32.07 | 31 36 | 68 | 3 | 22.67 | 23 96 | 31.27 | 26 92 | 21,197 | 3,052 | 6.95 | 8.02 | 8.84 | 7.60 |
| Sutherland | | . | .. | 15 50 | 14 33 | *16.78 | 84 | 7 | 12.00 | 15 53 | 13.70 | 17.18 | 6,274 | 1,621 | 3.87 | 4.42 | 3.66 | 3.76 |
| Wigtown | 4,562 | 174 | 26 22 | 26 98 | 32.07 | 30.07 | 29 | 1 | 29.00 | 27.71 | 32.67 | 29 20 | 7,257 | 1,450 | 5.00 | 5.06 | 5.16 | 4.38 |
| Total | 348,317 | 11,151 | 31.24 | 33.99 | 34.37 | 32 80 | 17,918 | 684 | 26.20 | 25.94 | 26.11 | 25.24 | 740,844 | 131,364 | 5.64 | 6.27 | 6.62 | 5.75 |

* Average for 9 years.

† Average for 6 years only

TABLE No. 4.—ESTIMATED TOTAL PRODUCE of TURNIPS (including SWEDES) and MANGELS, ACREAGE and Estimated AVERAGE YIELD per Acre in the Year 1903, compared with the Estimated YIELD for the Years 1902 and 1901, and the AVERAGE of the Ten Years, 1893-1902, in each COUNTY of SCOTLAND

| COUNTIES. | TURNIPS | | | | | | MANGELS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Produce in 1903 | Acreage in 1903 | Average Yield per Acre. | | | Average of the Ten Years, 1893-1902 | Total Produce in 1903 | Acreage in 1903. | Average Yield per Acre. | | | Average of the Ten Years, 1893-1902. |
| | | | 1903. | 1902. | 1901. | | | | 1903. | 1902. | 1901. | |
| | Tons. | Acres. | Tons | Tons. | Tons. | Tons. | Tons. | Acres. | Tons. | Tons. | Tons. | Tons. |
| Aberdeen | 1,050,356 | 89,521 | 11.73 | 12.14 | 13.46 | 14.15 | 34 | 3 | 11.33 | 13.50 | 14.25 | 11.81 |
| Argyll | 63,045 | 5,654 | 11.15 | 13.85 | 14.55 | 13.56 | 342 | 50 | 6.84 | 7.26 | 8.68 | 9.16 |
| Ayr | 105,296 | 6,624 | 15.90 | 22.00 | 20.11 | 18.47 | 10,019 | 663 | 15.11 | 18.94 | 20.95 | 18.98 |
| Banff | 269,945 | 22,200 | 12.16 | 16.09 | 19.69 | 16.08 | 24 | 4 | 6.00 | 6.57 | 12.30 | †12.55 |
| Berwick | 366,077 | 26,361 | 13.89 | 16.34 | 15.64 | 15.57 | 4,438 | 326 | 13.61 | 14.40 | 17.35 | 12.82 |
| Bute | 15,602 | 1,367 | 11.41 | 17.62 | 18.38 | 16.38 | 158 | 10 | 15.80 | 14.18 | 14.06 | 12.19 |
| Caithness | 128,735 | 13,447 | 9.57 | 15.39 | 10.98 | 14.20 | 27 | 5 | 5.40 | 7.00 | 6.57 | † 8.88 |
| Clackmannan | 8,130 | 831 | 9.78 | 11.67 | 11.39 | 11.28 | 138 | 14 | 9.86 | 9.25 | 10.00 | 9.72 |
| Dumbarton | 17,567 | 1,371 | 12.81 | 19.03 | 18.90 | 18.27 | 454 | 39 | 11.64 | 15.56 | 17.64 | 16.15 |
| Dumfries | 217,488 | 17,097 | 12.72 | 17.87 | 15.20 | 15.53 | 8,937 | 528 | 16.93 | 17.68 | 22.55 | 21.33 |
| Edinburgh | 206,469 | 11,055 | 18.68 | 19.92 | 18.89 | 18.49 | 1,274 | 59 | 21.59 | 20.21 | 23.95 | 18.43 |
| Elgin or Moray | 226,442 | 15,334 | 14.77 | 18.10 | 16.44 | 16.89 | 428 | 30 | 14.27 | 17.51 | 14.78 | 17.01 |
| Fife | 284,846 | 24,046 | 11.85 | 16.07 | 14.93 | 13.30 | 589 | 69 | 8.54 | 13.72 | 15.15 | 13.05 |
| Forfar | 525,797 | 33,444 | 15.72 | 18.81 | 20.88 | 17.31 | 1,210 | 89 | 13.60 | 15.64 | 21.95 | 22.11 |
| Haddington | 274,915 | 15,399 | 17.85 | 18.51 | 16.32 | 17.98 | 4,486 | 246 | 18.24 | 20.21 | 20.72 | 18.08 |
| Inverness | 89,425 | 10,910 | 8.20 | 8.53 | 10.04 | 10.74 | 110 | 15 | 7.33 | 7.97 | 7.96 | 11.79 |
| Kincardine | 183,000 | 17,739 | 10.32 | 13.85 | 14.13 | 14.70 | 30 | 3 | 10.00 | 15.00 | 15.00 | ‡14.78 |
| Kinross | 37,576 | 2,665 | 14.10 | 15.71 | 15.51 | 14.12 | 18 | 3 | 6.00 | 3.00 | 3.67 | . |
| Kirkcudbright | 163,373 | 11,634 | 14.04 | 18.88 | 18.63 | 16.95 | 2,481 | 162 | 15.31 | 16.09 | 18.88 | 17.61 |
| Lanark | 207,153 | 9,509 | 21.78 | 19.96 | 17.84 | 19.37 | 756 | 52 | 14.54 | 11.98 | 13.78 | 12.97 |
| Linlithgow | 55,264 | 3,653 | 15.13 | 18.26 | 16.52 | 17.25 | 468 | 29 | 16.14 | 18.14 | 15.92 | 14.84 |
| Nairn | 63,224 | 4,073 | 15.52 | 16.95 | 16.73 | 15.20 | 174 | 12 | 14.50 | 14.83 | 16.00 | §14.97 |
| Orkney | 120,218 | 14,768 | 8.14 | 11.00 | 10.59 | 9.59 | | | . | *— | *— | ‖ 0.29 |
| Peebles | 73,440 | 3,936 | 18.66 | 22.00 | 20.91 | 17.83 | 14 | 1 | 14.00 | 16.20 | 20.00 | .. |
| Perth | 395,792 | 28,962 | 13.67 | 18.38 | 14.57 | 15.22 | 968 | 117 | 8.27 | 13.89 | 12.29 | 11.48 |
| Renfrew | 31,375 | 2,254 | 13.92 | 15.58 | 16.40 | 16.79 | 863 | 67 | 12.88 | 13.09 | 15.79 | 15.17 |
| Ross and Cromarty | 124,012 | 15,981 | 7.76 | 8.59 | 8.09 | 9.79 | 802 | 115 | 6.97 | 7.83 | 7.90 | 11.56 |
| Roxburgh | 384,022 | 20,733 | 18.52 | 18.55 | 15.96 | 15.50 | 1,219 | 98 | 12.44 | 17.83 | 20.38 | 19.39 |
| Selkirk | 38,760 | 2,584 | 15.00 | 14.00 | 13.53 | 13.05 | 24 | 2 | 12.00 | 12.00 | 18.00 | . |
| Shetland | 15,608 | 1,540 | 10.14 | 14.56 | 16.03 | 15.44 | | .. | | .. | . | .. |
| Stirling | 46,688 | 4,280 | 10.91 | 15.03 | 13.93 | 14.39 | 226 | 20 | 11.30 | 13.59 | 15.26 | 13.64 |
| Sutherland | 20,325 | 3,059 | 6.64 | 7.84 | 7.12 | 8.79 | 12 | 2 | 6.00 | 7.00 | 7.00 | .. |
| Wigtown | 247,203 | 14,893 | 16.60 | 18.08 | 17.71 | 15.76 | 8,332 | 472 | 17.65 | 18.99 | 18.39 | 17.73 |
| Total | 6,057,168 | 456,924 | 13.26 | 15.67 | 15.30 | 15.08 | 49,055 | 3,305 | 14.84 | 16.68 | 18.71 | 17.72 |

* Crop failed. † Average of 9 years only. ‡ Average for 6 years only. § Average of 8 years only. ‖ Average for 7 years only.

TABLE No. 5.—ESTIMATED TOTAL PRODUCE OF HAY from Clover, Sainfoin, and Grasses under Rotation, also Total from Permanent Pasture, ACREAGE, and Estimated AVERAGE YIELD per Acre in the Year 1903, compared with the Estimated YIELD for the Years 1902 and 1901, and the AVERAGE of the Ten Years, 1893-1902, in each COUNTY of SCOTLAND.

| Counties. | From Clover, Sainfoin, and Grasses: Total Produce in 1903 | Acreage in 1903 | Average Yield per Acre: 1903 | 1902. | 1901 | Average of the Ten Years, 1893-1902. | From Permanent Pasture: Total Produce in 1903. | Acreage in 1903. | Average Yield per Acre: 1903. | 1902. | 1901. | Average of the Ten Years, 1893-1902. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cwt. | Acres. | Cwt | Cwt. | Cwt. | Cwt. | Cwt. | Acres | Cwt. | Cwt | Cwt. | Cwt. |
| Aberdeen | 1,260,797 | 47,892 | 26.33 | 30.51 | 28.54 | 27.60 | 26,349 | 2,064 | 12.77 | 13.87 | 18.27 | 20.28 |
| Argyll | 301,959 | 11,683 | 25.85 | 29.22 | 29.36 | 29.44 | 379,464 | 14,725 | 25.77 | 28.74 | 27.96 | 28.96 |
| Ayr | 985,933 | 32,506 | 30.33 | 34.86 | 33.17 | 34.18 | 579,050 | 16,460 | 35.18 | 41.40 | 38.42 | 37.09 |
| Banff | 189,356 | 9,887 | 19.15 | 28.75 | 30.05 | 28.21 | 10,797 | 518 | 20.84 | 21.21 | 17.36 | 20.58 |
| Berwick | 322,471 | 10,215 | 31.57 | 35.01 | 31.30 | 30.71 | 38,957 | 1,301 | 29.94 | 29.57 | 24.98 | 25.39 |
| Bute | 68,588 | 2,171 | 31.59 | 32.66 | 37.02 | 33.74 | 23,211 | 835 | 27.80 | 19.38 | 31.56 | 28.13 |
| Caithness | 101,582 | 9,276 | 10.95 | 15.44 | 19.48 | 21.85 | 5,804 | 1,374 | 3.86 | 5.87 | 8.20 | 10.04 |
| Clackmannan | 65,720 | 1,741 | 37.75 | 38.63 | 35.71 | 35.03 | 24,575 | 747 | 32.90 | 26.49 | 29.57 | 27.00 |
| Dumbarton | 229,454 | 7,103 | 32.30 | 38.70 | 39.34 | 38.60 | 57,341 | 1,537 | 37.31 | 37.73 | 38.17 | 40.88 |
| Dumfries | 383,902 | 18,976 | 20.23 | 26.23 | 25.89 | 26.44 | 504,892 | 18,415 | 27.42 | 32.25 | 27.69 | 30.54 |
| Edinburgh | 722,712 | 13,378 | 54.02 | 60.89 | 57.94 | 55.41 | 90,986 | 2,871 | 31.69 | 35.04 | 30.99 | 33.59 |
| Elgin or Moray | 143,716 | 5,971 | 24.07 | 29.55 | 26.16 | 26.48 | 9,024 | 459 | 19.66 | 28.15 | 21.80 | 21.83 |
| Fife | 805,495 | 27,387 | 29.41 | 31.65 | 31.21 | 30.57 | 128,622 | 4,618 | 27.85 | 27.00 | 24.38 | 26.00 |
| Forfar | 649,556 | 20,489 | 31.70 | 34.67 | 35.18 | 36.88 | 43,741 | 1,831 | 23.89 | 25.66 | 22.04 | 22.87 |
| Haddington | 540,391 | 10,413 | 51.90 | 57.56 | 48.29 | 51.25 | 46,463 | 1,760 | 26.40 | 31.33 | 26.34 | 29.59 |
| Inverness | 208,139 | 11,527 | 18.06 | 19.98 | 21.76 | 19.94 | 122,625 | 5,850 | 20.96 | 22.57 | 24.67 | 17.31 |
| Kincardine | 327,215 | 12,920 | 25.33 | 29.77 | 30.36 | 28.44 | 3,075 | 208 | 14.78 | 17.04 | 17.21 | 18.71 |
| Kinross | 69,005 | 2,847 | 24.24 | 32.09 | 28.10 | 27.81 | 23,884 | 860 | 27.77 | 33.74 | 28.09 | 30.81 |
| Kirkcudbright | 215,066 | 9,629 | 22.34 | 27.88 | 25.58 | 27.27 | 318,927 | 13,007 | 24.52 | 24.85 | 21.88 | 25.16 |
| Lanark | 1,213,157 | 34,847 | 34.81 | 37.01 | 34.92 | 36.76 | 449,193 | 12,862 | 34.92 | 36.03 | 31.16 | 35.85 |
| Linlithgow | 381,835 | 7,292 | 52.36 | 58.05 | 55.90 | 50.61 | 48,453 | 1,557 | 31.12 | 30.04 | 29.72 | 30.10 |
| Nairn | 34,266 | 2,117 | 16.19 | 21.38 | 19.10 | 21.05 | 1,105 | 82 | 13.48 | 14.23 | 14.33 | 17.04 |
| Orkney | 145,188 | 8,135 | 17.85 | 19.46 | 20.01 | 20.40 | 5,219 | *624 | 8.36 | 8.93 | 10.98 | 9.74 |
| Peebles | 80,171 | 2,410 | 33.27 | 35.93 | 33.34 | 31.17 | 33,608 | 987 | 34.05 | 37.73 | 33.44 | 30.08 |
| Perth | 837,089 | 30,960 | 27.04 | 32.34 | 31.44 | 30.56 | 255,639 | 11,503 | 22.17 | 23.57 | 22.16 | 23.73 |
| Renfrew | 460,487 | 13,978 | 32.94 | 30.63 | 38.59 | 39.02 | 257,343 | 5,998 | 42.90 | 49.20 | 46.28 | 46.28 |
| Ross and Cromarty | 227,091 | 14,073 | 16.14 | 17.28 | 15.98 | 18.75 | 21,389 | 3,009 | 7.11 | 7.15 | 7.19 | 8.35 |
| Roxburgh | 257,129 | 8,637 | 29.77 | 37.31 | 31.73 | 31.60 | 166,714 | 5,774 | 28.87 | 31.92 | 27.81 | 27.26 |
| Selkirk | 28,340 | 1,090 | 26.00 | 34.00 | 30.48 | 28.81 | 42,952 | 1,534 | 28.00 | 32.00 | 29.99 | 24.14 |
| Shetland | 14,665 | 878 | 16.70 | 13.94 | 16.49 | 20.39 | 24,573 | 1,628 | 15.09 | 10.97 | 14.30 | 15.77 |
| Stirling | 455,894 | 13,172 | 34.61 | 37.53 | 35.49 | 34.65 | 139,052 | 4,083 | 34.06 | 33.46 | 34.13 | 32.41 |
| Sutherland | 59,222 | 4,027 | 14.71 | 16.96 | 15.85 | 17.58 | 8,394 | 1,382 | 6.07 | 7.08 | 8.51 | 9.02 |
| Wigtown | 135,508 | 4,320 | 31.37 | 35.44 | 32.29 | 34.52 | 71,228 | 3,818 | 18.66 | 20.88 | 19.61 | 21.44 |
| Total | 11,921,099 | 411,947 | 28.94 | 33.21 | 31.87 | 31.83 | 3,961,549 | 144,281 | 27.46 | 30.17 | 27.97 | 28.85 |

* This Acreage is less than that stated in some other Tables by 695 acres, which were originally returned for the county of Orkney as "Grass for Hay," but were subsequently stated to have been used for grazing

TABLE NO. 6.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS IN EACH COUNTY OF SCOTLAND AS RETURNED ON JUNE 4, 1904.

| COUNTIES. | HORSES (including Ponies) | | | | CATTLE. | | | | SHEEP | | | PIGS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Used solely for Agriculture, &c.* | Unbroken Horses | | Total. | Cows and Heifers in Milk or in Calf. | Other Cattle | | Total. | 1 Year Old and above. | Under 1 Year. | Total. | |
| | | 1 Year and above. | Under 1 Year | | | 2 Years and above | Under 2 Years | | | | | |
| 1. Aberdeen | 23,601 | 5,844 | 2,280 | 31,725 | 44,539 | 41,351 | 85,925 | 171,815 | 115,553 | 88,583 | 204,136 | 13,509 |
| 2. Argyll | 4,428 | 1,311 | 517 | 6,256 | 22,465 | 12,694 | 26,645 | 61,804 | 573,753 | 265,370 | 839,123 | 4,151 |
| 3. Ayr | 7,487 | 1,603 | 566 | 9,656 | 51,483 | 14,463 | 36,588 | 102,534 | 222,829 | 140,769 | 363,598 | 12,681 |
| 4. Banff | 6,730 | 1,828 | 700 | 9,258 | 12,985 | 6,727 | 24,705 | 44,417 | 35,077 | 24,850 | 59,927 | 3,252 |
| 5. Berwick | 4,481 | 723 | 206 | 5,410 | 3,047 | 5,220 | 9,562 | 17,829 | 161,744 | 157,840 | 319,584 | 4,595 |
| 6. Bute | 946 | 234 | 79 | 1,259 | 3,664 | 1,630 | 4,470 | 9,764 | 28,712 | 14,655 | 43,367 | 611 |
| 7. Caithness | 4,349 | 964 | 334 | 5,647 | 7,963 | 3,138 | 12,290 | 23,391 | 75,115 | 48,011 | 123,126 | 1,675 |
| 8. Clackmannan | 548 | 116 | 48 | 712 | 1,496 | 834 | 1,279 | 3,609 | 8,114 | 5,580 | 13,694 | 1,855 |
| 9. Dumbarton | 1,429 | 300 | 107 | 1,836 | 8,429 | 2,203 | 3,957 | 14,589 | 43,310 | 23,973 | 67,283 | 1,320 |
| 10. Dumfries | 5,838 | 1,609 | 497 | 7,944 | 20,822 | 13,514 | 29,595 | 63,931 | 330,474 | 214,682 | 545,156 | 9,897 |
| 11. Edinburgh | 3,918 | 470 | 178 | 4,566 | 12,136 | 3,376 | 4,705 | 20,217 | 108,756 | 76,510 | 185,266 | 10,241 |
| 12. Elgin | 3,810 | 859 | 418 | 5,087 | 6,774 | 4,675 | 12,766 | 24,215 | 33,203 | 22,553 | 55,756 | 3,229 |
| 13. Fife | 7,967 | 1,601 | 543 | 10,111 | 12,199 | 17,030 | 17,935 | 47,164 | 60,018 | 45,345 | 105,363 | 5,307 |
| 14. Forfar | 8,579 | 1,126 | 468 | 10,173 | 12,796 | 17,401 | 19,690 | 49,887 | 93,903 | 66,331 | 160,234 | 7,860 |
| 15. Haddington | 3,273 | 239 | 104 | 3,616 | 1,928 | 4,391 | 3,025 | 9,344 | 70,762 | 52,752 | 123,514 | 1,956 |
| 16. Inverness | 7,157 | 1,371 | 910 | 9,438 | 22,025 | 7,179 | 22,420 | 51,624 | 370,890 | 173,919 | 544,809 | 2,517 |
| 17. Kincardine | 4,171 | 718 | 226 | 5,115 | 6,802 | 6,176 | 11,399 | 24,377 | 23,222 | 16,727 | 39,949 | 2,994 |
| 18. Kinross | 828 | 242 | 80 | 1,150 | 1,400 | 1,487 | 4,065 | 6,952 | 19,198 | 14,521 | 33,719 | 726 |
| 19. Kirkcudbright | 4,121 | 1,181 | 461 | 5,763 | 16,317 | 12,589 | 21,291 | 50,197 | 239,774 | 151,382 | 391,156 | 8,390 |
| 20. Lanark | 6,802 | 1,376 | 468 | 8,646 | 40,410 | 11,245 | 22,663 | 74,318 | 150,381 | 91,079 | 241,460 | 7,197 |
| 21. Linlithgow | 1,730 | 367 | 134 | 2,231 | 5,150 | 3,089 | 4,458 | 12,697 | 14,751 | 6,694 | 21,445 | 1,778 |
| 22. Nairn | 1,045 | 332 | 132 | 1,509 | 1,948 | 865 | 3,579 | 6,392 | 11,075 | 4,479 | 15,554 | 785 |
| 23. Orkney | 5,351 | 1,128 | 671 | 7,150 | 10,188 | 3,852 | 15,816 | 29,856 | 17,866 | 16,253 | 34,119 | 2,430 |
| 24. Shetland | 3,287 | 1,732 | 1,121 | 6,140 | 8,272 | 3,728 | 5,859 | 17,859 | 86,009 | 51,197 | 137,206 | 1,588 |
| 25. Peebles | 907 | 168 | 46 | 1,121 | 2,294 | 1,548 | 3,534 | 7,376 | 114,287 | 83,767 | 198,054 | 649 |
| 26. Perth | 10,368 | 1,899 | 670 | 12,937 | 17,975 | 18,727 | 37,811 | 74,513 | 433,747 | 226,614 | 660,361 | 7,951 |
| 27. Renfrew | 2,685 | 592 | 166 | 3,443 | 17,508 | 3,028 | 6,407 | 26,943 | 23,855 | 15,171 | 39,026 | 1,324 |
| 28. Ross and Cromarty | 6,052 | 1,282 | 598 | 7,932 | 17,814 | 7,973 | 19,273 | 45,060 | 172,391 | 89,922 | 262,313 | 5,059 |
| 29. Roxburgh | 3,608 | 335 | 114 | 4,087 | 4,731 | 4,955 | 9,541 | 19,227 | 286,463 | 236,544 | 523,007 | 3,288 |
| 30. Selkirk | 574 | 73 | 10 | 657 | 1,213 | 465 | 1,403 | 3,081 | 101,986 | 79,205 | 181,191 | 585 |
| 31. Stirling | 3,612 | 956 | 345 | 4,913 | 12,148 | 8,729 | 12,487 | 33,364 | 73,803 | 44,985 | 118,788 | 2,358 |
| 32. Sutherland | 2,210 | 232 | 112 | 2,554 | 5,824 | 1,959 | 5,001 | 12,784 | 135,015 | 65,554 | 200,569 | 820 |
| 33. Wigtown | 4,385 | 1,115 | 490 | 5,990 | 24,613 | 10,045 | 16,897 | 51,555 | 73,246 | 43,432 | 116,678 | 11,777 |
| Total | 156,277 | 33,956 | 13,799 | 204,032 | 439,358 | 256,286 | 517,041 | 1,212,685 | 4,309,282 | 2,659,249 | 6,968,531 | 144,185 |

* Including Mares kept for breeding.

## Table No. 7.—Quantity and Value of Corn, &c., imported into the United Kingdom in the undermentioned Years.

[*From Trade and Navigation Returns.*]

| | Quantities. | | | Values. | | |
|---|---|---|---|---|---|---|
| | 1902. | 1903. | 1904. | 1902. | 1903. | 1904. |
| Wheat from— | Cwt. | Cwt. | Cwt | £ | £ | £ |
| Russia . . . | 6,540,457 | 17,176,300 | 23,529,500 | 2,146,906 | 5,809,308 | 8,443,884 |
| Germany . . . | 239,910 | 310,176 | 251,000 | 79,122 | 105,554 | 91,351 |
| Turkey . . . | 345,525 | 433,004 | 431,200 | 104,537 | 134,985 | 127,268 |
| Roumania . . . | 2,362,453 | 3,140,727 | 1,491,800 | 758,703 | 1,055,912 | 512,001 |
| United States— | | | | | | |
| Atlantic Ports . | 30,669,521 | 18,419,336 | 4,948,400 | 10,165,400 | 6,395,154 | 1,763,362 |
| Pacific Ports . | 12,643,040 | 5,778,559 | 2,142,300 | 4,330,321 | 2,048,960 | 765,686 |
| Chile . . . . | 251,446 | 238,644 | 915,400 | 84,999 | 83,628 | 327,308 |
| Argentine Republic | 4,315,165 | 14,120,454 | 21,440,400 | 1,463,981 | 4,699,833 | 7,522,881 |
| British East Indies . | 8,841,586 | 17,057,857 | 25,485,000 | 2,938,008 | 5,653,066 | 8,498,529 |
| Australia . . | 4,174,753 | 26 | 10,272,600 | 1,483,126 | 10 | 3,754,402 |
| New Zealand | 156,626 | 204 | 358,100 | 53,841 | 46 | 123,633 |
| Canada . | 9,527,475 | 10,802,127 | 6,195,300 | 3,194,024 | 3,737,368 | 2,229,791 |
| Other countries . . | 934,270 | 653,616 | 352,600 | 276,855 | 216,372 | 118,253 |
| Total . . | 81,002,227 | 88,131,030 | 97,813,600 | 27,079,828 | 29,940,191 | 34,277,689 |
| Wheat and flour, from— | | | | | | |
| Germany . . | 16,206 | 37,020 | 264,740 | 7,339 | 17,481 | 142,710 |
| France . . | 713,935 | 577,498 | 1,486,920 | 287,258 | 238,708 | 647,482 |
| Austria-Hungary | 688,962 | 817,879 | 733,294 | 392,135 | 471,025 | 430,258 |
| United States . | 15,587,217 | 16,228,639 | 8,252,602 | 7,217,060 | 7,618,091 | 4,095,749 |
| Canada . . | 1,943,213 | 2,637,617 | 2,045,767 | 860,933 | 1,253,250 | 1,014,124 |
| Other countries . . | 486,806 | 307,795 | 1,939,570 | 151,892 | 125,097 | 928,338 |
| Total . . | 19,386,341 | 20,601,448 | 14,722,893 | 8,925,617 | 9,723,652 | 7,258,606 |
| Barley . . . | 25,200,837 | 26,555,867 | 27,152 320 | 7,131,712 | 7,221,780 | 7,161,600 |
| Oats . . . . | 15,857,167 | 16,283,763 | 14,097,900 | 5,041,323 | 4,263,950 | 3,729,677 |
| Peas . . . . | 2,035,110 | 1,820,923 | 2,179,456 | 740,128 | 690,768 | 767,029 |
| Beans . . . | 2,065,593 | 1,765,700 | 1,862,731 | 703,659 | 594,882 | 577,094 |
| Indian corn or maize | 44,492,977 | 50,099,328 | 42,898,780 | 11,713,182 | 12,465,588 | 10,247,214 |
| Indian corn meal | 242,841 | 590,416 | 316,660 | 83,270 | 176,622 | 100,940 |
| Oatmeal . . . | 612,602 | 728,973 | 648,745 | 486,241 | 537,415 | 456,703 |
| *Offals of corn and grain, including rice-meal | 3,306,489 | 2,617,966 | 3,136,565 | 724,9[illegible] | 586,272 | 591,242 |
| †Rice, rice-meal, and flour— | | | | | | |
| From Brit East Indies | 1,945,735 | | | 661,491 | | .. |
| From other countries | 602,953 | | .. | 267,729 | | |
| †Rice, exclusive of rice-meal— | | | | | | |
| From Brit East Indies | 2,044,678 | 3,491,506 | 4,372,743 | 683,378 | 1,453,185 | 1,597,599 |
| From other countries | 858,839 | 1,199,414 | 1,396,270 | 401,189 | 597,315 | 672,308 |
| Other kinds of grain and corn | 1,547,707 | 1,737,076 | 1,564,170 | 461,779 | 540,634 | 475,304 |
| Other kinds of meal and flour | 207,863 | 87,498 | 96,264 | 77,593 | 35,869 | 38,540 |
| Total of corn, &c | | .. | . | 65,183,032 | 68,778,077 | 67,951,345 |

* Shown separately from 1st July 1902.

† The aggregate totals for the year 1902 are for the six months ended 30th June, after which Rice-meal is included with "Offals of Corn and Grain."

## Table No. 8.—Return of the Average Prices of Wool in the Years 1902 and 1903.

| Years. | Australian. | South African. | English Fleeces. |
|---|---|---|---|
| | Per lb. s. d. | Per lb. s. d. | Per lb. s. d. s. d |
| 1902 . . . . | 0 8$\frac{5}{8}$ | 0 7$\frac{3}{8}$ | 0 5 to 0 9$\frac{1}{2}$ |
| 1903 . . . . | 0 9$\frac{1}{8}$ | 0 7$\frac{1}{2}$ | 0 6$\frac{1}{2}$ " 0 11$\frac{1}{2}$ |

TABLE No. 9.—QUANTITIES AND VALUES OF CORN, MEAT, FOOD PRODUCTS,
in the Year 1904, with the

[*From Trade and*

| | Quantities. | | | Values. | | |
|---|---|---|---|---|---|---|
| | 1902. | 1903 | 1904. | 1902. | 1903. | 1904. |
| ANIMALS, LIVING:— | No | No | No. | £ | £ | £ |
| Cattle . . . | 419,488 | 522,546 | 549,532 | 7,814,753 | 9,209,122 | 9,736,436 |
| Sheep and lambs . . . | 293,203 | 354,241 | 382,240 | 454,422 | 546,063 | 591,984 |
| Swine . . . . | | .. | .. | . | .. | .. |
| Total value | .. | . | .. | 8,269,175 | 9,755,185 | 10,328,420 |
| *GRAIN, FLOUR, &c — | Cwt. | Cwt. | Cwt. | £ | £ | £ |
| Wheat . . . | 81,002,227 | 88,131,030 | 97,813,600 | 27,079,823 | 29,940,191 | 34,277,689 |
| Wheat meal and flour . | 19,386,341 | 20,601,445 | 14,722,893 | 8,925,617 | 9,723,652 | 7,258,606 |
| Barley . . . . . | 25,200,837 | 26,555,867 | 27,152,320 | 7,131,712 | 7,221,789 | 7,161,600 |
| Oats . . . . | 15,857,167 | 16,283,763 | 14,097,900 | 5,041,323 | 4,263,950 | 3,729,677 |
| Peas . . | 2,035,110 | 1,829,923 | 2,179,456 | 740,123 | 690,768 | 767,029 |
| Beans . . | 2,065,593 | 1,765,700 | 1,862,734 | 703,659 | 594,832 | 577,094 |
| Maize or Indian corn | 44,492,977 | 50,099, 28 | 42,898,780 | 11,713,132 | 12,465,583 | 10,247,214 |
| Maize-meal . | 242,841 | 590,416 | 316,660 | 83,270 | 176,622 | 100,940 |
| Oatmeal . | 612,602 | 728,973 | 648,745 | 486,241 | 537,415 | 456,703 |
| †Offals of corn and grain, including rice meal | 3,306,489 | 2,617,966 | 3,316,565 | 724,973 | 536,272 | 591,242 |
| ‡Rice, rice meal, and flour — From British East Indies | 1,945,735 | . | | 661,491 | | .. |
| From other countries | 602,953 | | | 267,729 | . | . |
| ‡Rice, exclusive of rice-meal— From British East Indies | 2,044,673 | 3,491,506 | 4,372,743 | 683,378 | 1,458,185 | 1,597,899 |
| From other countries | 858,839 | 1,199,414 | 1,396,270 | 401,189 | 597,315 | 672,308 |
| Other kinds of grain & corn | 1,547,707 | 1,737,076 | 1,564,170 | 461,779 | 540,634 | 475,304 |
| Other kinds of meal and flour | 207,863 | 87,498 | 96,264 | 77,593 | 35,869 | 38,540 |
| Total value | .. | .. | . | 65,183,032 | 68,778,077 | 67,951,845 |
| MEAT — | Cwt | Cwt | Cwt | £ | £ | £ |
| Beef, salted . . . . | 153,574 | 173,692 | 144,304 | 244,002 | 245,605 | 187,288 |
| " fresh . . . | 3,707,387 | 4,159,606 | 4,367,322 | 7,905,064 | 8,366,141 | 8,080,257 |
| Mutton, fresh . . | 3,659,599 | 4,016,622 | 3,494,782 | 6,914,911 | 7,826,062 | 6,861,531 |
| Bacon . . . . | 5,089,704 | 5,156,988 | 5,452,311 | 13,426,967 | 13,619,140 | 12,832,142 |
| Hams . . . . | 1,482,287 | 1,141,332 | 1,244,013 | 3,858,902 | 3,142,574 | 3,104,999 |
| Pork, salted (not bacon or hams) | 205,259 | 237,574 | 243,842 | 305,584 | 319,256 | 294,080 |
| Pork, fresh . . . | 655,376 | 705,844 | 610,485 | 1,446,145 | 1,555,452 | 1,378,467 |
| Meat, unenumerated — salted or fresh | 655,023 | 663,261 | 631,012 | 1,199,110 | 1,206,052 | 1,164,012 |
| Meat preserved otherwise than by salting | 911,356 | 767,563 | 814,398 | 2,786,194 | 2,435,777 | 2,461,841 |
| Rabbits . . . . . | 451,457 | 475,645 | 533,698 | 734,326 | 723,881 | 780,737 |
| Total of dead meat . | 16,971,022 | 17,498,127 | 17,536,167 | 38,821,205 | 39,439,940 | 37,145,354 |
| DAIRY PRODUCE:— | Cwt. | Cwt. | Cwt. | £ | £ | £ |
| Butter . . . . . | 3,974,933 | 4,060,694 | 4,241,005 | 20,526,690 | 20,798,707 | 21,117,162 |
| Margarine . . . . | 966,170 | 882,123 | 960,278 | 2,569,503 | 2,313,618 | 2,494,467 |
| Cheese . . . . . | 2,546,212 | 2,694,358 | 2,554,298 | 6,412,002 | 7,054,710 | 5,843,773 |
| Total . | 7,487,315 | 7,637,175 | 7,755,581 | 29,508,195 | 30,167,035 | 29,455,402 |

* Grain and Flour were subject to duty from the 15th April 1902 to the 30th June 1903.
† Shown separately from 1st July 1902
‡ The aggregate totals for the year 1902 are for the six months ended 30th June, after which date Rice-meal is included with "Offals of Corn and Grain."

**AND ARTICLES AFFECTING AGRICULTURE,** imported into the United Kingdom Corresponding Figures for 1902 and 1903.

*Navigation Returns.*]

| | Quantities. | | | Values. | | |
|---|---|---|---|---|---|---|
| | 1902. | 1903. | 1904. | 1902. | 1903. | 1904. |
| POULTRY, &c. :— | | | | £ | £ | £ |
| Poultry and game, alive or dead | .. | .. | .. | 1,059,044 | 1,202,288 | 1,217,176 |
| | Gt Hunds | Gt. Hunds | Gt Hunds | | | |
| Eggs . . . . . . | 18,966,795 | 19,848,897 | | 6,308,985 | 6,617,599 | 6,780,574 |
| Total value | .. | . | . | 7,368,029 | 7,819,887 | 7,947,750 |
| FRUIT, VEGETABLES, &c. – | Cwt | Cwt | Cwt | £ | £ | £ |
| Apples . . . | 2,843,517 | 4,569,546 | 3,771,781 | 1,923,474 | 2,781,643 | 2,118,374 |
| Cherries | 166,359 | 110,192 | 260,880 | 216,421 | 167,142 | 819,969 |
| Plums . | 541,136 | 594,626 | 498,984 | 515,059 | 622,268 | 537,485 |
| Pears . | 491,906 | 271,518 | 542,624 | 439,536 | 326,463 | 510,691 |
| Grapes | 632,932 | 684,084 | 853,572 | 676,992 | 715,057 | 827,634 |
| Oranges | 6,518,107 | 6,176,752 | 5,853,253 | 2,358,708 | 2,275,400 | 2,193,144 |
| Lemons | 1,003,293 | 978,318 | 989,296 | 417,152 | 406,728 | 408,500 |
| Unenumerated | 500,679 | 688,873 | 654,765 | 308,998 | 449,413 | 872,575 |
| Onions . . . | 7,605,489 | 8,619,919 | 8,291,814 | 999,942 | 1,003,016 | 1,076,419 |
| Potatoes . . . | 5,699,090 | 9,150,202 | 10,003,267 | 1,589,432 | 2,603,238 | 2,440,001 |
| Vegetables, unenumerated (raw) | .. | . | .. | 468,411 | 396,784 | 457,491 |
| Hops . . . . | 191,324 | 113,998 | 313,667 | 798,586 | 578,789 | 1,889,851 |
| Total value | | . | | 10,712,711 | 12,325,891 | 13,102,131 |
| OTHER ARTICLES.— | Cwt | Cwt | Cwt | £ | £ | £ |
| Lard . . . | 1,650,830 | 1,732,790 | 1,830,837 | 4,118,992 | 3,870,774 | 3,342,395 |
| | Lb. | Lb. | Lb | | | |
| Wool, sheep and lambs' | 637,129,783 | 599,500,932 | 561,706,689 | 19,924,255 | 20,622,523 | 20,366,930 |
| Wood and timber— | Loads. | Loads. | Loads. | | | |
| Hewn (pit props or pit wood) | 1,978,485 | 2,321,348 | 2,332,577 | 2,091,906 | 2,535,365 | 2,485,113 |
| Sawn or split, planed or dressed | 6,676,726 | 6,742,233 | 6,066,162 | 17,171,422 | 18,192,519 | 15,505,625 |
| Staves . . | 119,992 | 129,773 | 132,178 | 668,630 | 570,859 | 525,696 |
| | Tons. | Tons | Tons. | | | |
| Oilseed-cake . . | 387,667 | 367,791 | 371,691 | 2,472,938 | 2,165,430 | 2,128,111 |
| Seeds— | Cwt. | Cwt. | Cwt. | | | |
| Clover and grass | 337,802 | 458,046 | 426,475 | 740,387 | 1,008,772 | 869,838 |
| | Tons. | Tons. | Tons | | | |
| Cotton . . . | 550,620 | 587,491 | 468,653 | 3,285,650 | 2,984,096 | 2,537,490 |
| | Qrs | Qrs | Qrs | | | |
| Flax or linseed . | 1,818,829 | 2,185,694 | 2,785,783 | 4,486,997 | 4,179,727 | 4,502,116 |
| Rape . . . . | 228,275 | 308,296 | 309,325 | 385,708 | 417,271 | 386,440 |
| | Tons | Tons. | Tons. | | | |
| Bones (whether burnt or not) . . . | 58,973 | 52,996 | 35,108 | 224,123 | 232,592 | 153,398 |
| Guano . . . . . | 29,293 | 32,801 | 24,276 | 186,926 | 180,891 | 117,758 |
| | Cwt. | Cwt. | Cwt. | | | |
| Cotton, raw . . . . | 16,220,874 | 16,009,813 | 17,454,897 | 41,149,202 | 44,836,116 | 54,698,288 |
| | Tons | Tons. | Tons. | | | |
| Hemp . . . | 115,069 | 116,717 | 132,612 | 3,913,094 | 3,551,431 | 4,129,192 |
| Flax . . . . | 73,420 | 94,701 | 84,917 | 2,944,390 | 3,675,604 | 3,285,475 |
| Hides untanned— | Cwt | Cwt. | Cwt. | | | |
| Dry . . . . . . | 286,334 | 291,670 | 325,268 | 845,484 | 877,663 | 940,606 |
| Wet . . . . | 661,198 | 493,748 | 449,625 | 1,595,109 | 1,229,727 | 1,106,454 |
| | Gallons. | Gallons | Gallons. | | | |
| Petroleum . . . | 284,899,710 | 285,862,638 | 302,132,143 | 5,198,582 | 5,295,351 | 5,830,134 |

TABLE No. 10.—QUANTITY AND VALUE OF DEAD MEAT imported into the United Kingdom in the undermentioned Years.

[*From Trade and Navigation Returns.*]

| | Quantities. | | | Values. | | |
|---|---|---|---|---|---|---|
| | 1902. | 1903. | 1904. | 1902. | 1903. | 1904. |
| BACON, from— | Cwt. | Cwt. | Cwt. | £ . | £ | £ |
| Denmark . . . | 1,255,627 | 1,496,101 | 1,723,884 | 3,749,108 | 4,294,017 | 4,532,420 |
| Canada . . . | 462,487 | 665,249 | 829,888 | 1,203,280 | 1,691,687 | 1,865,159 |
| United States . | 3,283,855 | 2,893,507 | 2,806,108 | 8,239,522 | 7,370,928 | 6,209,009 |
| Other countries . . | 87,735 | 102,131 | 92,436 | 235,057 | 262,508 | 225,554 |
| Total . | 5,089,704 | 5,156,988 | 5,452,811 | 13,426,967 | 13,619,140 | 12,832,142 |
| BEEF (salted), from— | | | | | | |
| United States . | 143,994 | 165,176 | 135,280 | 227,283 | 232,293 | 173,098 |
| Other countries . . | 9,580 | 8,516 | 9,024 | 16,719 | 13,312 | 14,190 |
| Total . . | 153,574 | 173,692 | 144,304 | 244,002 | 245,605 | 187,288 |
| BEEF (fresh), from— | | | | | | |
| United States | 2,290,465 | 2,693,920 | 2,895,836 | 5,204,057 | 5,739,750 | 5,180,286 |
| Argentine Republic | 923,748 | 1,152,211 | 1,675,271 | 1,723,652 | 2,053,669 | 2,482,704 |
| Australia . | 65,860 | 77,656 | 93,636 | 115,916 | 122,511 | 127,695 |
| New Zealand . | 237,257 | 159,830 | 175,012 | 417,199 | 271,247 | 281,046 |
| Other countries . | 190,057 | 75,989 | 27,567 | 444,240 | 178,964 | 58,526 |
| Total . . | 3,707,387 | 4,159,606 | 4,867,322 | 7,905,064 | 8,366,141 | 8,080,257 |
| HAMS, from— | | | | | | |
| Canada . . | 163,930 | 197,497 | 196,732 | 420,319 | 524,542 | 485,527 |
| United States . . | 1,312,779 | 939,169 | 1,042,669 | 3,422,004 | 2,602,654 | 2,606,129 |
| Other countries . . | 5,578 | 4,666 | [illegible] 612 | 16,579 | 15,378 | 13,343 |
| Total . . | 1,482,287 | 1,141,332 | 1,244,018 | 3,858,902 | 3,142,574 | 3,104,999 |
| MEAT (unenumerated, salted or fresh), from— | | | | | | |
| Holland . . . | 291,059 | 269,541 | 265,895 | 623,619 | 571,762 | 584,895 |
| United States . . | 163,348 | 179,212 | 132,539 | 259,900 | 283,766 | 210,624 |
| Other countries . . | 200,616 | 214,508 | 233,078 | 315,591 | 350,524 | 368,493 |
| Total . . | 655,023 | 663,261 | 631,012 | 1,199,110 | 1,206,052 | 1,164,012 |
| MEAT, preserved otherwise than by salting— | | | | | | |
| Beef . . . . | 578,426 | 472,615 | 556,918 | 1,710,383 | 1,511,846 | 1,611,698 |
| Mutton . . . | 85,496 | 49,154 | 37,257 | 206,562 | 106,328 | 88,708 |
| Other sorts . . | 247,434 | 245,794 | 220,223 | 869,249 | 817,603 | 761,440 |
| Total | 911,356 | 767,563 | 814,398 | 2,786,194 | 2,435,777 | 2,461,841 |
| MUTTON (fresh), from— | | | | | | |
| Holland . . | 343,759 | 257,521 | 265,702 | 780,520 | 580,673 | 605,225 |
| Australia . . | 279,134 | 181,269 | 163,014 | 543,570 | 365,384 | 324,239 |
| New Zealand . . | 1,635,037 | 2,035,434 | 1,626,893 | 3,218,720 | 4,153,269 | 3,391,025 |
| Argentine Republic . | 1,352,501 | 1,485,770 | 1,422,397 | 2,273,027 | 2,603,931 | 2,491,210 |
| Other countries . . | 49,168 | 56,628 | 16,776 | 99,074 | 122,805 | 49,882 |
| Total . | 3,659,599 | 4,016,622 | 3,494,782 | 6,914,911 | 7,826,062 | 6,861,581 |
| PORK (salted, not Bacon or Hams), from— | | | | | | |
| United States . | 105,416 | 90,849 | 76,977 | 187,133 | 158,318 | 119,423 |
| Other countries . . | 99,843 | 146,725 | 166,865 | 118,453 | 160,938 | 174,657 |
| Total . | 205,259 | 237,574 | 243,842 | 305,586 | 319,256 | 294,080 |
| PORK (fresh), from— | | | | | | |
| Holland . . | 353,898 | 527,269 | 448,154 | 752,089 | 1,122,202 | 1,005,450 |
| Belgium . . | 34,656 | 39,745 | 32,798 | 83,722 | 97,990 | 83,061 |
| United States . . | 252,421 | 132,695 | 119,259 | 572,328 | 319,634 | 262,450 |
| Other countries . | 14,901 | 6,135 | 10,274 | 38,006 | 15,626 | 27,506 |
| Total | 655,376 | 705,844 | 610,485 | 1,446,145 | 1,555,452 | 1,378,467 |
| RABBITS (dead), from— | | | | | | |
| Belgium . . | 77,555 | 68,716 | 77,407 | 226,300 | 197,950 | 224,791 |
| Australia . . | 196,974 | 243,864 | 322,833 | 246,795 | 285,718 | 357,710 |
| New Zealand . | 144,063 | 134,171 | 107,147 | 173,332 | 159,757 | 121,799 |
| Other countries . . | 32,865 | 28,894 | 26,311 | 87,899 | 80,456 | 76,437 |
| Total . . | 451,457 | 475,645 | 533,698 | 734,326 | 723,881 | 780,737 |
| Total of dead meat | 16,071,022 | 17,498,127 | 17,586,167 | 38,821,205 | 39,489,940 | 37,145,354 |

TABLE No. 11.—QUANTITIES AND VALUES OF BUTTER, MARGARINE, CHEESE, AND EGGS imported into the United Kingdom in each Year from 1902 to 1904 inclusive.

[*From Trade and Navigation Returns.*]

| | Quantities. | | | Values | | |
|---|---|---|---|---|---|---|
| | 1902. | 1903. | 1904. | 1902. | 1903. | 1904. |
| BUTTER from— | Cwt. | Cwt. | Cwt. | £ | £ | £ |
| Russia . . | 490,091 | 484,328 | 404,717 | 2,196,234 | 2,190,560 | 1,817,736 |
| Sweden . . | 191,591 | 212,232 | 206,791 | 995,838 | 1,108,980 | 1,062,353 |
| Denmark . | 1,703,032 | 1,771,654 | 1,708,619 | 9,302,362 | 9,572,439 | 9,008,089 |
| Germany . | 26,375 | 12,507 | 4,080 | 145,399 | 65,165 | 20,547 |
| Holland . . | 393,261 | 343,761 | 252,262 | 1,973,930 | 1,718,692 | 1,225,768 |
| France . . | 414,240 | 454,088 | 371,061 | 2,233,122 | 2,351,402 | 1,961,094 |
| New S. Wales | 17,621 | 20,371 | 159,622 | 88,256 | 99,629 | 747,876 |
| Queensland . | 20 | 786 | 59,475 | 104 | 3,725 | 270,231 |
| Victoria . . | 62,519 | 98,177 | 255,716 | 312,578 | 469,168 | 1,212,660 |
| New Zealand . | 157,993 | 249,879 | 294,982 | 781,872 | 1,245,022 | 1,394,455 |
| Canada . . | 285,765 | 185,437 | 268,607 | 1,347,345 | 866,249 | 1,194,823 |
| United States . | 54,458 | 42,405 | 68,754 | 252,874 | 190,678 | 294,584 |
| Other countries | 177,967 | 185,069 | 186,319 | 896,776 | 916,998 | 911,946 |
| Total . | 3,974,933 | 4,060,694 | 4,241,005 | 20,526,690 | 20,798,707 | 21,117,162 |
| MARGARINE from— | Cwt. | Cwt | Cwt. | £ | £ | £ |
| Norway . . | 6,067 | 5,210 | 5,667 | 14,918 | 12,987 | 14,081 |
| Holland . . | 914,323 | 843,016 | 927,980 | 2,409,257 | 2,188,461 | 2,390,243 |
| France . . | 34,731 | 28,795 | 23,580 | 117,853 | 99,751 | 82,305 |
| Other countries | 11,049 | 5,102 | 3,051 | 27,475 | 12,419 | 7,838 |
| Total . | 966,170 | 882,123 | 960,278 | 2,569,503 | 2,313,618 | 2,494,467 |
| CHEESE from— | Cwt. | Cwt. | Cwt. | £ | £ | £ |
| Holland . . | 284,020 | 302,503 | 233,602 | 668,308 | 706,832 | 542,533 |
| France . . | 36,801 | 36,004 | 44,268 | 113,611 | 113,531 | 138,289 |
| Australia . | 7 | | 350 | 18 | | 831 |
| New Zealand . | 51,875 | 56,339 | 84,947 | 131,036 | 168,071 | 217,286 |
| Canada . . | 1,709,565 | 1,848,142 | 1,900,556 | 4,301,859 | 4,823,090 | 4,234,790 |
| United States . | 390,479 | 360,916 | 224,830 | 962,112 | 953,215 | 503,312 |
| Other countries | 73,465 | 90,454 | 65,745 | 235,058 | 289,971 | 206,732 |
| Total . | 2,546,212 | 2,694,358 | 2,551,298 | 6,412,002 | 7,054,710 | 5,843,773 |
| EGGS from— | Great Hundreds. | Great Hundreds | Great Hundreds | £ | £ | £ |
| Russia . . | 5,339,045 | 6,802,773 | 7,032,906 | 1,509,751 | 1,866,421 | 2,042,520 |
| Denmark . | 3,518,212 | 3,851,557 | 3,602,326 | 1,366,073 | 1,648,367 | 1,461,459 |
| Germany . | 3,931,280 | 3,087,748 | 3,554,232 | 1,260,871 | 994,797 | 1,191,161 |
| Belgium . . | 2,627,457 | 2,291,262 | 2,517,073 | 827,914 | 725,680 | 837,120 |
| France . . | 1,680,433 | 1,601,940 | 1,698,614 | 717,474 | 670,104 | 710,057 |
| Canada . . | 517,822 | 557,080 | 317,722 | 209,316 | 218,571 | 129,631 |
| Other countries | 1,352,546 | 1,656,534 | 1,219,721 | 417,583 | 493,659 | 358,626 |
| Total . | 18,966,795 | 19,848,894 | 19,942,594 | 6,308,985 | 6,617,599 | 6,730,574 |

TABLE No. 12.—PRICES OF LIVE STOCK IN 1901, 1902, AND 1903, as returned under the Markets and Fairs (Weighing of Cattle) Act, 1891.

*[From Journal of the Board of Agriculture.]*

NUMBER OF ANIMALS REPORTED AS ENTERING THE 19 SCHEDULED PLACES IN GREAT BRITAIN, TOGETHER WITH THE NUMBERS WEIGHED AND THE NUMBERS PRICED.

| ANIMALS | 1901. | 1902. | 1903. |
|---|---|---|---|
| CATTLE :— | No | No | No |
| Entering markets | 1,161,516 | 1,302,601 | 1,262,301 |
| Weighed | 156,289 | 184,499 | 183,466 |
| Prices returned | 131,792 | 145,996 | 147,903 |
| Prices returned with breed and quality distinguished | 109,590 | 121,453 | 123,946 |
| SHEEP :— | | | |
| Entering markets | 4,314,232 | 4,508,045 | 4,223,877 |
| Weighed | 39,371 | 42,832 | 36,679 |
| Prices returned with breed and quality distinguished | 32,439 | 34,695 | 30,810 |
| SWINE.— | | | |
| Entering markets | 383,875 | 414,351 | 483,232 |
| Weighed | 2,167 | 2,722 | 3,034 |
| Prices returned with quality distinguished | 2,161 | 2,585 | 2,996 |

CALCULATED AVERAGE PRICE PER LIVE CWT. IN TWELVE SELECTED PLACES.

*(Obtained by dividing the total price by the total weight of the weighed animals of all descriptions in each of the three qualities or grades.)*

| PLACES | Inferior or third quality. | | | | Good or second quality. | | | | Prime or first quality | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1902. | | 1903. | | 1902. | | 1903. | | 1902 | | 1903. | |
| | Per cwt s | d | Per cwt s | d | Per cwt s | d | Per cwt. s | d. | Per cwt s | d. | Per cwt. s | d |
| ENGLAND :— | | | | | | | | | | | | |
| Carlisle | 27 | 6 | 27 | 6 | 31 | 0 | 30 | 8 | 35 | 6 | 35 | 6 |
| Leeds | | | ... | | 33 | 2 | 31 | 10 | 36 | 4 | 35 | 6 |
| Liverpool | 28 | 2 | 26 | 6 | 32 | 0 | 30 | 2 | 36 | 2 | 34 | 6 |
| London | 29 | 2 | 28 | 8 | 36 | 2 | 33 | 10 | 40 | 6 | 37 | 10 |
| Newcastle | .. | | .. | | 34 | 4 | 33 | 4 | 39 | 8 | 37 | 6 |
| Shrewsbury | 29 | 6 | 29 | 6 | 33 | 4 | 33 | 10 | 37 | 4 | 36 | 2 |
| SCOTLAND :— | | | | | | | | | | | | |
| Aberdeen | 26 | 8 | 26 | 6 | 35 | 8 | 34 | 6 | 39 | 0 | 37 | 2 |
| Dundee | 26 | 2 | 25 | 0 | 36 | 0 | 34 | 6 | 39 | 8 | 37 | 8 |
| Edinburgh | | | 32 | 0 | 37 | 2 | 35 | 4 | 40 | 0 | 37 | 8 |
| Falkirk | 31 | 4 | 30 | 8 | 35 | 0 | 34 | 10 | 38 | 4 | 37 | 2 |
| Glasgow | 35 | 6 | 34 | 4 | 36 | 10 | 35 | 10 | 38 | 4 | 36 | 8 |
| Perth | 31 | 4 | 31 | 2 | 35 | 2 | 34 | 4 | 39 | 0 | 37 | 4 |

TABLE No. 13.—NUMBER AND VALUE OF LIVE CATTLE, SHEEP, AND SWINE imported into the United Kingdom in the undermentioned Years. [*From Trade and Navigation Returns.*]

| | Number. | | | Value. | | |
|---|---|---|---|---|---|---|
| | 1902 | 1903. | 1904. | 1902. | 1903. | 1904. |
| CATTLE, from | | | | £ | £ | £ |
| Channel Islands | 1,380 | 1,721 | 1,684 | 25,571 | 31,035 | 28,921 |
| Canada . | 93,674 | 190,815 | 146,599 | 1,644,478 | 3,315,776 | 2,547,453 |
| United States | 321,481 | 301,757 | 401,249 | 6,144,046 | 5,399,243 | 7,160,062 |
| Argentine Republic | | 27,817 | | .. | 455,671 | |
| Other countries | 3 | 436 | | 55 | 7,397 | |
| Total | 419,488 | 522,546 | 549,532 | 7,814,753 | 9,209,122 | 9,736,436 |
| SHEEP AND LAMBS, from | | | | | | |
| Canada | 55,033 | 83,291 | 77,885 | 86,501 | 129,045 | 121,709 |
| United States | 233,227 | 171,386 | 294,804 | 361,736 | 264,416 | 456,630 |
| Argentine Republic | | 82,941 | | | 134,239 | |
| Other countries | 4,943 | 16,623 | 9,601 | 6,185 | 18,363 | 10,555 |
| Total | 293,203 | 354,241 | 382,240 | 454,422 | 546,063 | 591,984 |
| SWINE (not separately enumerated) | | | | . | . | — |
| TOTAL VALUE OF ANIMALS LIVING | | | | 8,269,175 | 9,755,185 | 10,328,420 |

TABLE No. 14.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS imported into Great Britain from Ireland in each of the Years 1898-1904.

| | 1898. | 1899 | 1900. | 1901. | 1902. | 1903. | 1904. |
|---|---|---|---|---|---|---|---|
| HORSES.— | | | | | | | |
| Stallions | 150 | 122 | 103 | 194 | 222 | 265 | 235 |
| Mares | 18,200 | 19,538 | 16,320 | 11,467 | 11,143 | 12,867 | 12,909 |
| Geldings | 20,454 | 22,562 | 19,183 | 13,946 | 13,895 | 14,587 | 14,356 |
| Total | 38,804 | 42,222 | 35,606 | 25,607 | 25,260 | 27,719 | 27,500 |
| CATTLE Oxen, Bulls, and Cows— | | | | | | | |
| Fat | 278,770 | 278,220 | 275,450 | 261,690 | 306,892 | 216,887 | 232,186 |
| Store . | 460,903 | 443,456 | 427,891 | 344,954 | 556,554 | 556,506 | 470,361 |
| Other cattle | 4,101 | 6,219 | 7,442 | 6,269 | 10,634 | 6,724 | 6,896 |
| Calves | 59,588 | 45,099 | 34,736 | 29,725 | 85,161 | 87,528 | 62,920 |
| Total | 803,362 | 772,994 | 745,519 | 642,638 | 959,241 | 897,645 | 772,363 |
| SHEEP:— | | | | | | | |
| Sheep. . | 449,558 | 452,214 | 478,081 | 484,516 | 599,319 | 444,762 | 372,159 |
| Lambs | 383,900 | 423,664 | 384,182 | 358,809 | 456,483 | 380,917 | 367,107 |
| Total | 833,458 | 875,878 | 862,263 | 848,325 | 1,055,802 | 825,679 | 739,266 |
| PIGS.— | | | | | | | |
| Fat . . | 556,723 | 650,850 | 673,847 | 559,282 | 603,108 | 541,601 | 478,922 |
| Store . . | 32,062 | 37,710 | 41,355 | 36,807 | 34,864 | 28,319 | 26,158 |
| Total . | 588,785 | 688,560 | 715,202 | 596,129 | 637,972 | 569,920 | 505,080 |

EDINBURGH CORN-MARKET GRAIN TABLES for **Wheat, Barley, Oats, and Beans, showing the Quantity offered for Sale, the Quantity Sold, the Highest, Lowest, and Average Prices; also the Bushel-weights of the Highest and Lowest Prices of each kind of Grain for every Market-day, likewise the Results for every Month, and the final Result for the year 1904.**

## WHEAT.

| Date. | Quantity offered for Sale. | Quantity Sold. | Highest Price | Lowest Price. | Average Price. | Table of Bushel-weights for Highest Price. | | Table of Bushel-weights for Lowest Price. | |
|---|---|---|---|---|---|---|---|---|---|
| 1904 Jan. | Imp. qr. | Imp qr | s. d. | s. d | s d | lb | lb | lb. | lb |
| 6 | 818 | 263 | 30 0 | 27 0 | 29 3 | | 63 | | 59½ |
| 13 | 480 | 439 | 30 0 | 26 6 | 28 10 | 62 | 63 | | 61 |
| 20 | 429 | 313 | 30 6 | 25 0 | 28 8 | | 63 | | 59 |
| 27 | 634 | 287 | 30 0 | 26 0 | 28 4 | | 63 | | 61½ |
| | 1,861 | 1,302 | 30 1 | 26 2 | 28 9 | | | | |
| Feb 3 | 377 | 220 | 29 6 | 25 0 | 27 8 | | 63 | | 63 |
| 10 | 274 | 80 | 30 0 | | 30 0 | | 63 | | |
| 17 | 544 | 282 | 30 0 | 28 0 | 29 7 | 62½ | 63 | | 61½ |
| 24 | 490 | 297 | 31 0 | 25 0 | 29 8 | 62 | 63 | | 59½ |
| | 1,685 | 879 | 30 3 | 25 11 | 29 2 | | | | |
| March 2 | 449 | 224 | 30 6 | 23 6 | 28 9 | | 63 | | 56 |
| 9 | 472 | 333 | 30 3 | 26 0 | 29 1 | | 63 | | 60 |
| 16 | 451 | 381 | 30 0 | 28 6 | 29 5 | | 63 | 61 | 62 |
| 23 | 417 | 335 | 30 3 | 27 0 | 29 6 | | 63 | | 61½ |
| 30 | 420 | 410 | 30 6 | 23 0 | 28 9 | | 63 | | 55¾ |
| | 2,209 | 1,683 | 30 3 | 25 3 | 29 1 | | | | |
| April 6 | 194 | 140 | 30 6 | 28 0 | 29 8 | | 63 | | 60 |
| 13 | 414 | 407 | 31 6 | 28 0 | 29 11 | | 63 | | 61 |
| 20 | 404 | 377 | 31 0 | 22 0 | 29 3 | | 63 | | 57½ |
| 27 | 531 | 464 | 31 0 | 27 6 | 29 7 | | 64 | | 60½ |
| | 1,543 | 1,388 | 30 11 | 26 2 | 29 7 | | | | |
| May 4 | 1,624 | 1,189 | 30 9 | 21 6 | 29 2 | | 64½ | | 57½ |
| 11 | 1,692 | 1,248 | 30 0 | 25 0 | 28 7 | 62 | 64½ | | 63 |
| 18 | 1,251 | 854 | 30 0 | 25 0 | 28 8 | | 63 | | 63 |
| 25 | 1,122 | 795 | 30 0 | 28 0 | 29 1 | | 64 | | 63 |
| | 5,689 | 4,086 | 30 2 | 24 2 | 28 11 | | | | |
| June 1 | 960 | 615 | 29 3 | 25 0 | 28 3 | | 63 | | 59½ |
| 8 | 1,815 | 1,431 | 29 6 | 25 6 | 28 0 | 63 | 64 | | 60¼ |
| 15 | 2,033 | 1,605 | 29 0 | 26 6 | 28 1 | | 63 | | 60½ |
| 22 | 1,720 | 1,405 | 29 6 | 24 0 | 28 0 | | 63 | | 58½ |
| 29 | 1,745 | 1,112 | 28 9 | 24 6 | 27 10 | | 63 | | 61½ |
| | 8,273 | 6,168 | 29 3 | 25 9 | 28 0 | | | | |
| July 6 | 830 | 675 | 29 0 | 20 0 | 27 4 | | 63 | | 57½ |
| 13 | 399 | 265 | 29 6 | 27 6 | 28 5 | 63 | 64 | | 62 |
| 20 | 509 | 240 | 30 0 | 28 6 | 29 0 | | 63 | | 63 |
| 27 | 1,397 | 1,156 | 30 0 | 22 0 | 28 5 | | 64½ | | 59 |
| | 3,135 | 2,336 | 29 8 | 24 3 | 28 2 | | | | |

## WHEAT—*continued.*

| Date. | Quantity offered for Sale. | Quantity Sold. | Highest Price. | Lowest Price. | Average Price. | Table of Bushel-weights for Highest Price. | | Table of Bushel-weights for Lowest Price. | |
|---|---|---|---|---|---|---|---|---|---|
| 1904 Aug. | Imp. qr. | Imp. qr | s. d. | s. d | s d. | lb | lb. | lb. | lb. |
| 3 | 1,624 | 1,323 | 30 6 | 28 0 | 29 6 | | 63 | 60 | 60¾ |
| 10 | 1,362 | 256 | 31 0 | 29 0 | 30 2 | | 63 | | 62 |
| 17 | 1,830 | 1,214 | 30 6 | 28 0 | 29 9 | 63 | 63½ | | 62 |
| 24 | 1,220 | 485 | 30 6 | 24 0 | 29 11 | 62 | 63 | 58½ | 60 |
| 31 | 1,611 | 809 | 30 6 | 29 0 | 29 10 | | 63 | 62 | 63 |
| | 7,647 | 4,087 | 30 6 | 28 5 | 29 9 | | | | |
| Sept. | | | | | | | | | |
| 7 | 1,037 | 605 | 30 0 | 23 0 | 29 0 | | 63 | | 61 |
| 14 | 454 | 270 | 32 0 | 27 6 | 30 4 | | 63 | | 59 |
| 21 | 566 | 436 | 30 6 | 26 0 | 29 1 | | 63 | 60 | 61 |
| 28 | 320 | 252 | 32 0 | 30 0 | 31 0 | | 63 | | 65 |
| | 2,377 | 1,563 | 30 10 | 26 8 | 29 7 | | | | |
| Oct | | | | | | | | | |
| 5 | 476 | 109 | 34 0 | 26 6 | 31 1 | 63 | 64½ | | 61 |
| 12 | 1,150 | 612 | 35 0 | 26 0 | 29 11 | | 64 | | 61½ |
| 19 | 978 | 320 | 35 0 | 25 9 | 29 0 | | 63 | | 61 |
| 26 | 1,298 | 357 | 35 0 | 27 6 | 30 10 | | 63 | | 62 |
| | 3,902 | 1,398 | 34 6 | 26 6 | 30 0 | | | | |
| Nov. | | | | | | | | | |
| 2 | 975 | 251 | 35 0 | 23 0 | 30 9 | 63 | 64 | | 58½ |
| 9 | 869 | 444 | 35 0 | 27 0 | 30 4 | 62 | 63 | | 62 |
| 16 | 843 | 573 | 34 0 | 25 0 | 29 7 | | 63 | | 58½ |
| 23 | 558 | 377 | 32 0 | 26 0 | 28 7 | | 63 | | 60 |
| 30 | 490 | 484 | 32 0 | 26 0 | 29 6 | | 63 | 60 | 62 |
| | 3,785 | 2,129 | 34 3 | 24 9 | 29 8 | | | | |
| Dec | | | | | | | | | |
| 7 | 459 | 413 | 31 0 | 25 0 | 29 9 | | 63 | | 60 |
| 14 | 169 | 169 | 31 0 | 29 6 | 30 1 | | 63½ | | 62 |
| 21 | 536 | 409 | 31 6 | 26 6 | 30 5 | | 63 | | 60 |
| 28 | 392 | 296 | 31 8 | 28 6 | 30 11 | | 63 | | 63 |
| | 1,556 | 1,287 | 31 3 | 28 5 | 30 3 | | | | |
| Result for year | 43,612 | 28,306 | 30 7 | 26 2 | 29 0 | | | | |

## BARLEY.

| Date. | Quantity offered for Sale. | Quantity Sold. | Highest Price. | Lowest Price. | Average Price. | Highest Price. | | Lowest Price. | |
|---|---|---|---|---|---|---|---|---|---|
| 1904 Jan. | | | | | | | | | |
| 6 | 2,435 | 1,850 | 28 6 | 13 0 | 24 3 | 55 | 56 | | 50 |
| 13 | 1,610 | 988 | 29 6 | 16 0 | 25 6 | | 56 | | 52½ |
| 20 | 2,182 | 1,541 | 29 3 | 17 0 | 24 4 | | 55½ | | 53¼ |
| 27 | 2,669 | 1,805 | 31 9 | 17 0 | 24 10 | | 55 | | 58½ |
| | 8,896 | 6,184 | 29 5 | 15 10 | 24 8 | | | | |
| Feb. | | | | | | | | | |
| 3 | 2,369 | 838 | 31 0 | 14 0 | 24 4 | | 56 | | 51½ |
| 10 | 2,800 | 1,432 | 29 6 | 13 6 | 24 6 | 54¾ | 56 | | 51¼ |
| 17 | 2,536 | 1,062 | 30 0 | 16 9 | 25 9 | | 56 | | 52½ |
| 24 | 2,958 | 1,748 | 32 0 | 13 6 | 24 4 | | 56 | | 51 |
| | 10,663 | 5,080 | 30 1 | 14 7 | 24 8 | | | | |

## Barley—*continued.*

| Date | Quantity offered for Sale | Quantity Sold | Highest Price. | Lowest Price | Average Price. | Table of Bushel-weights for Highest Price | Table of Bushel-weights for Lowest Price. |
|---|---|---|---|---|---|---|---|
| 1904 March | Imp qr | Imp. qr | s d | s d. | s d | lb lb | lb lb |
| 2 | 2,411 | 798 | 30 0 | 14 6 | 23 9 | 56 | 50 |
| 9 | 2,164 | 854 | 40 0 | 12 0 | 23 11 | 56 | 50 |
| 16 | 1,697 | 688 | 30 0 | 17 6 | 24 4 | 56 | 56 |
| 23 | 1,590 | 823 | 30 0 | 14 0 | 21 11 | 55 | 50 |
| 30 | 1,226 | 482 | 30 0 | 14 0 | 25 3 | 54 56 | 52 |
| | 9,088 | 3,645 | 30 6 | 14 0 | 23 8 | | |
| April | | | | | | | |
| 6 | 1,324 | 530 | 31 0 | 15 0 | 23 7 | 56 | 50¼ 51½ |
| 13 | 919 | 378 | 29 0 | 14 0 | 22 11 | 56 | 49½ |
| 20 | 619 | 409 | 29 0 | 16 0 | 24 8 | 56 | 51½ |
| 27 | 602 | 440 | 29 3 | 13 6 | 24 10 | 55 56 | 50½ |
| | 3,464 | 1,757 | 29 3 | 14 0 | 24 0 | | |
| May | | | | | | | |
| 4 | 701 | 408 | 25 0 | 16 0 | 22 7 | 55 56 | 50 |
| 11 | 584 | 388 | 24 6 | 16 0 | 21 10 | 55 | 52½ |
| 18 | 776 | 359 | 25 0 | 20 0 | 23 2 | 55½ | 54 |
| 25 | 459 | 45 | 25 0 | 22 0 | 23 8 | 56 | 55 |
| | 2,520 | 1,200 | 24 10 | 18 3 | 22 7 | | |
| June | | | | | | | |
| 1 | 285 | 75 | 24 0 | 22 0 | 23 6 | 56 | 55 |
| 8 | 421 | 208 | 24 0 | 19 0 | 23 2 | 56 | 52 |
| 15 | 258 | 116 | 24 0 | 17 0 | 22 8 | 55 | 53 |
| 22 | 168 | 65 | 25 0 | 15 6 | 20 1 | 56 | 51½ |
| 29 | 101 | 41 | 20 0 | 17 0 | 18 6 | 54 | 52 |
| | 1,233 | 505 | 23 0 | 17 11 | 22 4 | | |
| July | | | | | | | |
| 6 | 109 | 26 | 19 0 | 15 6 | 17 0 | 54 | 54 |
| 13 | 20 | 20 | 18 0 | | 18 0 | 53 | .. |
| 20 | 125 | | | | | | |
| 27 | 38 | 18 | 20 0 | | 20 0 | 56 | |
| | 292 | 64 | 19 0 | 15 6 | 18 6 | | |
| Aug | | | | | | | |
| 3 | 20 | | | | | | |
| 10 | | | | | | | |
| 17 | 115 | 35 | 20 0 | | 20 0 | 55 | |
| 24 | 132 | 80 | 23 0 | | 23 0 | 56 | |
| 31 | 187 | 25 | 26 6 | | 26 6 | 54 | |
| | 454 | 140 | 22 11 | | 22 11 | | |
| Sept. | | | | | | | |
| 7 | 940 | 594 | 29 0 | 18 0 | 26 3 | 56 | 51½ |
| 14 | 2,036 | 1,291 | 28 0 | 22 0 | 26 8 | 56 | 53½ |
| 21 | 2,783 | 2,360 | 29 0 | 22 6 | 25 7 | 56 | 56 |
| 28 | 3,127 | 2,013 | 28 0 | 22 0 | 25 4 | 56 | 54½ |
| | 8,895 | 6,258 | 28 3 | 21 9 | 25 9 | | |
| Oct | | | | | | | |
| 5 | 2,225 | 1,473 | 28 3 | 19 6 | 24 10 | 55 | 53¼ |
| 12 | 2,687 | 1,592 | 29 0 | 22 0 | 24 1 | 56 | 54 56 |
| 19 | 2,277 | 1,472 | 28 0 | 20 6 | 24 7 | 56 | 52 |
| 26 | 1,683 | 779 | 29 0 | 22 6 | 25 3 | 56 | 55 |
| | 8,872 | 5,316 | 28 4 | 21 10 | 24 7 | | |

## BARLEY—*continued.*

| Date. | Quantity offered for Sale. | Quantity Sold | Highest Price. | | Lowest Price. | | Average Price. | | Table of Bushel-weights for Highest Price. | | Lowest Price | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1904 Nov | Imp. qr | Imp. qr. | s | d | s. | d. | s. | d. | lb | lb | lb. | lb |
| 2 | 1,650 | 1,129 | 26 | 6 | 21 | 0 | 24 | 9 | 54½ | 56 | | 53¼ |
| 9 | 2,248 | 1,524 | 27 | 9 | 22 | 0 | 25 | 1 | | 55 | | 56 |
| 16 | 2,071 | 1,260 | 28 | 3 | 20 | 6 | 25 | 0 | | 56 | | 54 |
| 23 | 2,051 | 1,495 | 27 | 6 | 22 | 9 | 25 | 9 | | 56 | | 54 |
| 30 | 2,938 | 2,310 | 28 | 0 | 23 | 0 | 25 | 6 | | 56 | 54¼ | 55 |
| | 10,958 | 7,718 | 27 | 8 | 21 | 7 | 25 | 3 | | | | |
| Dec. 7 | 1,676 | 862 | 27 | 0 | 19 | 0 | 24 | 6 | | 56 | | 49 |
| 14 | 1,753 | 1,264 | 26 | 9 | 22 | 6 | 25 | 1 | | 56 | | 54 |
| 21 | 2,002 | 1,113 | 28 | 3 | 22 | 0 | 25 | 9 | | 56½ | | 50 |
| 28 | 1,859 | 1,261 | 26 | 0 | 24 | 0 | 25 | 6 | | 56 | 54 | 56 |
| | 7,290 | 4,500 | 27 | 6 | 23 | 4 | 25 | 3 | | | | |
| Result for year | 72,625 | 42 367 | 27 | 7 | 19 | 4 | 24 | 9 | | | | |

## OATS.

| Date. | Quantity offered for Sale. | Quantity Sold | Highest Price. | | Lowest Price. | | Average Price. | | Table of Bushel-weights for Highest Price. | | Lowest Price | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1904 Jan. 6 | 3,816 | 2,034 | 25 | 6 | 13 | 0 | 20 | 2 | 44½ | 45 | | 40 |
| 13 | 4,047 | 1,261 | 24 | 3 | 11 | 0 | 19 | 2 | | 45½ | | 39½ |
| 20 | 4,100 | 2,208 | 26 | 0 | 12 | 6 | 19 | 11 | | 44½ | | 37 |
| 27 | 3,702 | 1,755 | 25 | 6 | 13 | 0 | 19 | 9 | | 44½ | | 42 |
| | 15,665 | 7,258 | 25 | 6 | 12 | 7 | 19 | 10 | | | | |
| Feb 3 | 4,164 | 1,634 | 24 | 6 | 12 | 9 | 19 | 10 | | 45 | | 40 |
| 10 | 3,623 | 1,291 | 24 | 0 | 12 | 6 | 20 | 0 | 44½ | 45½ | | 39 |
| 17 | 3,693 | 1,387 | 26 | 0 | 12 | 0 | 20 | 8 | | 42 | | 38 |
| 24 | 4,138 | 2,158 | 24 | 6 | 13 | 0 | 20 | 6 | | 45½ | | 37 |
| | 15,618 | 6,470 | 24 | 7 | 12 | 8 | 20 | 3 | | | | |
| March 2 | 4,174 | 1,661 | 25 | 0 | 15 | 0 | 20 | 0 | | 44½ | | 40 |
| 9 | 5,181 | 1,440 | 25 | 6 | 14 | 6 | 21 | 3 | 42 | 44½ | | 42 |
| 16 | 4,307 | 1,064 | 26 | 0 | 11 | 6 | 20 | 5 | | 44½ | | 38½ |
| 23 | 3,769 | 1,858 | 25 | 6 | 16 | 6 | 21 | 1 | | 44½ | | 40 |
| 30 | 3,027 | 1,067 | 25 | 0 | 16 | 0 | 20 | 6 | | 42 | | 42 |
| | 20,458 | 6,590 | 25 | 5 | 14 | 7 | 20 | 8 | | | | |
| April 6 | 3,249 | 1,070 | 25 | 6 | 14 | 0 | 20 | 1 | | 44½ | | 37½ |
| 13 | 2,355 | 1,163 | 24 | 0 | 17 | 0 | 20 | 4 | 44½ | 45 | | 42 |
| 20 | 2,175 | 1,020 | 24 | 6 | 17 | 0 | 22 | 2 | | 44½ | | 41 |
| 27 | 2,785 | 1,658 | 24 | 6 | 16 | 6 | 20 | 10 | | 44½ | | 40 |
| | 10,564 | 4,911 | 24 | 5 | 16 | 2 | 20 | 10 | | | | |
| May 4 | 2,533 | 1,425 | 24 | 9 | 16 | 6 | 22 | 4 | | 44½ | 40 | 42 |
| 11 | 3,344 | 1,426 | 23 | 6 | 14 | 6 | 21 | 5 | 44 | 45½ | | 40 |
| 18 | 3,086 | 1,548 | 24 | 0 | 16 | 6 | 21 | 3 | | 44½ | | 40 |
| 25 | 1,654 | 596 | 23 | 6 | 16 | 6 | 20 | 10 | | 44½ | | 40 |
| | 10,617 | 4,995 | 23 | 10 | 16 | 3 | 21 | 7 | | | | |

## OATS—*continued.*

| Date. | Quantity offered for Sale. | Quantity Sold. | Highest Price | | Lowest Price. | | Average Price. | | Table of Bushel-weights for Highest Price | | Lowest Price. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1904 | Imp qr | Imp. qr | s. | d. | s. | d | s. | d. | lb | lb. | lb. | lb |
| June | | | | | | | | | | | | |
| 1 | 1,772 | 877 | 23 | 6 | 17 | 9 | 21 | 9 | 44 | 45¼ | | 41½ |
| 8 | 1,680 | 566 | 24 | 0 | 18 | 0 | 21 | 8 | | 45 | | 41 |
| 15 | 2,448 | 1,404 | 24 | 0 | 17 | 6 | 21 | 7 | | 45½ | | 42 |
| 22 | 2,832 | 1,194 | 24 | 1½ | 18 | 0 | 22 | 2 | | 45 | | 41 |
| 29 | 2,020 | 578 | 24 | 0 | 19 | 0 | 21 | 11 | | 45½ | | 42 |
| | 10,252 | 4,619 | 23 | 9 | 18 | 0 | 21 | 10 | | | | |
| July | | | | | | | | | | | | |
| 6 | 1,984 | 976 | 24 | 0 | 15 | 6 | 21 | 6 | | 45 | | 42 |
| 13 | 1,228 | 364 | 24 | 0 | 19 | 0 | 22 | 3 | | 44½ | | 42 |
| 20 | 1,113 | 491 | 24 | 0 | 20 | 0 | 21 | 8 | | 43 | | 42 |
| 27 | 1,359 | 650 | 25 | 0 | 20 | 6 | 23 | 3 | 44 | 45 | | 42 |
| | 5,684 | 2,481 | 24 | 5 | 18 | 9 | 22 | 1 | | | | |
| Aug | | | | | | | | | | | | |
| 3 | 2,033 | 883 | 25 | 0 | 18 | 0 | 22 | 6 | 44 | 44½ | | 40 |
| 10 | 2,289 | 911 | 25 | 6 | 19 | 9 | 22 | 3 | | 44½ | | 42 |
| 17 | 2,422 | 807 | 25 | 0 | 19 | 6 | 21 | 8 | | 44½ | | 42 |
| 24 | 2,363 | 1,018 | 25 | 0 | 20 | 0 | 21 | 11 | 44½ | 45½ | 42 | 43½ |
| 31 | 2,848 | 1,508 | 25 | 0 | 19 | 0 | 21 | 8 | | 44½ | | 42 |
| | 11,955 | 5,127 | 25 | 0 | 19 | 3 | 22 | 0 | | | | • |
| Sept | | | | | | | | | | | | |
| 7 | 3,002 | 1,629 | 23 | 0 | 16 | 0 | 20 | 11 | 44½ | 45½ | | 44½ |
| 14 | 2,410 | 1,436 | 23 | 6 | 18 | 6 | 21 | 4 | | 44½ | | 42½ |
| 21 | 3,071 | 2,058 | 22 | 0 | 18 | 0 | 20 | 7 | 44½ | 45½ | 42 | 43 |
| 28 | 2,515 | 1,417 | 21 | 6 | 16 | 6 | 19 | 9 | 44 | 44½ | | 42 |
| | 10,998 | 6,540 | 22 | 2 | 17 | 5 | 20 | 8 | | | | |
| Oct | | | | | | | | | | | | |
| 5 | 2,640 | 1,601 | 21 | 6 | 17 | 3 | 19 | 3 | | 44 | | 42 |
| 12 | 2,630 | 1,862 | 23 | 0 | 15 | 6 | 19 | 9 | 43½ | 44 | | 41 |
| 19 | 3,165 | 1,083 | 22 | 0 | 15 | 6 | 20 | 0 | | 45½ | | 39¼ |
| 26 | 3,081 | 1,633 | 21 | 6 | 17 | 0 | 19 | 3 | 44 | 45 | | 42 |
| | 11,516 | 6,179 | 21 | 10 | 16 | 8 | 19 | 6 | | | | |
| Nov | | | | | | | | | | | | |
| 2 | 2,895 | 984 | 21 | 0 | 16 | 3 | 18 | 8 | 42 | 44½ | | 42 |
| 9 | 2,991 | 1,323 | 21 | 3 | 13 | 6 | 19 | 6 | | 44½ | | 42 |
| 16 | 2,657 | 1,174 | 21 | 0 | 14 | 0 | 19 | 3 | | 45 | | 38 |
| 23 | 2,727 | 1,478 | 21 | 6 | 15 | 0 | 19 | 5 | | 43½ | | 42¾ |
| 30 | 2,930 | 1,727 | 21 | 6 | 16 | 9 | 19 | 6 | | 46 | | 42 |
| | 14,200 | 6,681 | 21 | 3 | 15 | 6 | 19 | 3 | | | | |
| Dec | | | | | | | | | | | | |
| 7 | 2,284 | 1,127 | 21 | 6 | 16 | 0 | 19 | 0 | | 45¼ | | 42 |
| 14 | 2,662 | 1,342 | 22 | 0 | 17 | 0 | 19 | 7 | | 44½ | 40 | 42 |
| 21 | 2,247 | 1,378 | 22 | 0 | 16 | 6 | 19 | 4 | | 45½ | 41 | 42 |
| 28 | 2,137 | 916 | 21 | 0 | 15 | 0 | 19 | 3 | | 44½ | | 41 |
| Result for year | 9,330 | 4,763 | 21 | 8 | 16 | 7 | 19 | 4 | | | | |
| | 146,857 | 66,614 | 23 | 4 | 16 | 6 | 20 | 6 | | | | |

## BEANS.

| Date. | Quantity offered for Sale | Quantity Sold. | Highest Price. | Lowest Price | Average Price | Table of Bushel-weights for Highest Price | | Table of Bushel-weights for Lowest Price | |
|---|---|---|---|---|---|---|---|---|---|
| 1904 Jan. | Imp qr | Imp qr | s d | s d | s d. | lb | lb | lb | lb |
| 6 | | | | | | | | | |
| 13 | | | | | | | | | |
| 20 | | | | | | | | | |
| 27 | 25 | | | | | | | | |
| | 25 | | | | | | | | |
| Feb 3 | 105 | 22 | 32 0 | 30 6 | 30 11 | | 63 | | 62 |
| 10 | 56 | | | | | | | | |
| 17 | 102 | 45 | 32 0 | 31 0 | 31 1 | | 63 | | 62½ |
| 24 | 58 | 35 | 30 6 | | 30 6 | | 63 | | |
| | 321 | 102 | 30 10 | 30 10 | 30 10 | | | | |
| March 2 | 213 | 86 | 32 6 | 31 0 | 31 10 | | 63¼ | 63 | 64 |
| 9 | 196 | 95 | 33 0 | 30 6 | 32 1 | | 63¾ | | 63 |
| 16 | 101 | 28 | 30 6 | 29 0 | 30 1 | | 64 | | 62 |
| 23 | 84 | 75 | 32 6 | 26 6 | 27 0 | | 63¾ | | 63 |
| 30 | 64 | | | | | | | | |
| | 658 | 284 | 32 2 | 29 7 | 30 6 | | | | |
| April 6 | | | | | | | | | |
| 13 | | | | | | | | | |
| 20 | | | | | | | | | |
| 27 | 4 | 4 | 26 0 | | 26 0 | | 60½ | | |
| | 4 | 4 | 26 0 | | 26 0 | | | | |
| May 4 | | | | | | | | | |
| 11 | 37 | | | | | | | | |
| 18 | 36 | | | | | | | | |
| 25 | 36 | | | | | | | | |
| | 109 | | | | | | | | |
| June 1 | | | | | | | | | |
| 8 | | | | | | | | | |
| 15 | | | | | | | | | |
| 22 | 30 | 30 | 31 0 | | 31 0 | | 63 | | |
| 29 | 30 | | | | | | | | |
| | 60 | 30 | 31 0 | | 31 0 | | | | |
| July 6 | 30 | | | | | | | | |
| 13 | | | | | | | | | |
| 20 | | | | | | | | | |
| 27 | | | | | | | | | |
| | 30 | | | | | | | | |
| Aug 3 | 20 | | | | | | | | |
| 10 | | | | | | | | | |
| 17 | | | | | | | | | |
| 24 | | | | | | | | | |
| 31 | | | | | | | | | |
| | 20 | | | | | | | | |

BEANS—*continued.*

| Date | Quantity offered for Sale | Quantity Sold | Highest Price | Lowest Price | Average Price. | Table of Bushel-weights for Highest Price | Table of Bushel-weights for Lowest Price |
|---|---|---|---|---|---|---|---|
| 1904 Sept | Imp qr | Imp qr | s d | s d | s d | lb lb | lb lb |
| 7 | | | | | | | |
| 14 | 15 | | | | | | |
| 21 | | | | | | | |
| 28 | | | | | | | |
| | 15 | | | | | | |
| Oct | | | | | | | |
| 5 | | | | | | | |
| 12 | | | | | | | |
| 19 | | | | | | | |
| 26 | | | | | | | |
| Nov | | | | | | | |
| 2 | | | | | | | |
| 9 | | | | | | | |
| 16 | | | | | | | |
| 23 | | | | | | | |
| 30 | 15 | | | | | | |
| | 15 | | | | | | |
| Dec | | | | | | | |
| 7 | | | | | | | |
| 14 | | | | | | | |
| 21 | 15 | | | | | | |
| 28 | | | | | | | |
| | 15 | | | | | | |
| Result for year | 1,272 | 420 | 31 5 | 30 1 | 30 7 | | |

# PRICES OF SHEEP SINCE 1818

## TABLE No. 1.—CHEVIOT SHEEP

| Year. | Wethers. | | | | | Ewes | | | | | Lambs. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s. | d. | | s. | d. | s. | d. | | s. | d. | s. | d. | | s. | d. |
| 1818 | 28 | 0 | to | 30 | 0 | not quoted | | | | | 8 | 0 | to | 10 | 0 |
| 1819 | 25 | 0 | ″ | 27 | 0 | 15 | 0 | to | 17 | 0 | 10 | 6 | ″ | 12 | 0 |
| 1820 | 20 | 0 | ″ | 25 | 0 | 16 | 0 | ″ | 17 | 0 | 10 | 0 | ″ | 11 | 0 |
| 1821 | 18 | 0 | ″ | 20 | 0 | 14 | 0 | ″ | 16 | 0 | 7 | 6 | ″ | 8 | 0 |
| 1822 | 12 | 6 | ″ | 13 | 0 | 8 | 0 | ″ | 8 | 6 | 4 | 6 | ″ | 0 | 0 |
| 1823 | 13 | 6 | ″ | 18 | 0 | 7 | 0 | ″ | 10 | 6 | 5 | 6 | ″ | 6 | 0 |
| 1824 | 14 | 0 | ″ | 19 | 0 | 7 | 0 | ″ | 9 | 0 | 4 | 6 | ″ | 6 | 0 |
| 1825 | 29 | 0 | ″ | 32 | 0 | 15 | 0 | ″ | 19 | 0 | 9 | 0 | ″ | 10 | 6 |
| 1826 | 17 | 6 | ″ | 21 | 6 | 13 | 0 | ″ | 15 | 0 | 7 | 0 | ″ | 7 | 6 |
| 1827 | 15 | 0 | ″ | 24 | 0 | not quoted | | | | | 7 | 0 | ″ | 8 | 0 |
| 1828 | 18 | 0 | ″ | 27 | 6 | 12 | 0 | to | 15 | 0 | 7 | 0 | ″ | 8 | 3 |
| 1829 | 18 | 0 | ″ | 24 | 0 | 12 | 6 | ″ | 14 | 0 | 7 | 0 | ″ | 8 | 6 |
| 1830 | 15 | 0 | ″ | 21 | 0 | 8 | 0 | ″ | 11 | 0 | 6 | 0 | ″ | 6 | 9 |
| 1831 | 18 | 0 | ″ | 25 | 0 | 9 | 0 | ″ | 13 | 0 | 7 | 0 | ″ | 8 | 0 |
| 1832 | 19 | 0 | ″ | 24 | 0 | 11 | 0 | ″ | 16 | 0 | 7 | 0 | ″ | 9 | 0 |
| 1833 | 22 | 0 | ″ | 31 | 0 | 13 | 6 | ″ | 20 | 0 | 8 | 0 | ″ | 11 | 3 |
| 1834 | 22 | 0 | ″ | 31 | 0 | 13 | 6 | ″ | 21 | 0 | 9 | 0 | ″ | 11 | 6 |
| 1835 | 22 | 0 | ″ | 27 | 6 | 18 | 0 | ″ | 20 | 6 | 8 | 0 | ″ | 11 | 0 |
| 1836 | 24 | 0 | ″ | 31 | 6 | 16 | 0 | ″ | 19 | 0 | 10 | 0 | ″ | 14 | 0 |
| 1837 | 19 | 0 | ″ | 28 | 0 | 14 | 0 | ″ | 19 | 0 | 10 | 0 | ″ | 13 | 0 |
| 1838 | 23 | 0 | ″ | 30 | 6 | 17 | 0 | ″ | 22 | 0 | 12 | 0 | ″ | 14 | 0 |
| 1839 | 23 | 0 | ″ | 31 | 0 | 14 | 0 | ″ | 19 | 0 | 0 | 0 | ″ | 13 | 0 |
| 1840 | 24 | 0 | ″ | 33 | 0 | 15 | 0 | ″ | 23 | 0 | 7 | 0 | ″ | 11 | 6 |
| 1841 | 23 | 0 | ″ | 30 | 0 | 14 | 0 | ″ | 22 | 0 | 8 | 0 | ″ | 12 | 0 |
| 1842 | 22 | 6 | ″ | 28 | 0 | 13 | 0 | ″ | 17 | 0 | 7 | 6 | ″ | 10 | 0 |
| 1843 | 19 | 0 | ″ | 25 | 0 | 8 | 0 | ″ | 12 | 0 | 5 | 0 | ″ | 8 | 0 |
| 1844 | 21 | 0 | ″ | 29 | 0 | 10 | 0 | ″ | 16 | 0 | 8 | 0 | ″ | 10 | 6 |
| 1845 | 23 | 0 | ″ | 33 | 0 | 13 | 0 | ″ | 20 | 0 | 8 | 0 | ″ | 13 | 0 |
| 1846 | 24 | 0 | ″ | 33 | 6 | 14 | 6 | ″ | 21 | 6 | 10 | 0 | ″ | 14 | 6 |
| 1847 | 24 | 0 | ″ | 35 | 0 | 13 | 0 | ″ | 24 | 0 | 11 | 6 | ″ | 15 | 0 |
| 1848 | 23 | 0 | ″ | 34 | 6 | 13 | 0 | ″ | 28 | 0 | 11 | 6 | ″ | 15 | 0 |
| 1849 | 21 | 0 | ″ | 30 | 2 | 12 | 0 | ″ | 21 | 0 | 0 | 0 | ″ | 14 | 0 |
| 1850 | 20 | 6 | ″ | 29 | 6 | 12 | 0 | ″ | 20 | 0 | 8 | 0 | ″ | 13 | 0 |
| 1851 | 21 | 6 | ″ | 31 | 0 | 13 | 0 | ″ | 21 | 0 | 8 | 9 | ″ | 14 | 0 |
| 1852 | 21 | 0 | ″ | 32 | 0 | 15 | 0 | ″ | 23 | 0 | 8 | 0 | ″ | 14 | 0 |
| 1853 | 26 | 6 | ″ | 38 | 0 | 17 | 0 | ″ | 28 | 6 | 9 | 0 | ″ | 17 | 0 |
| 1854 | 25 | 0 | ″ | 36 | 0 | 17 | 0 | ″ | 26 | 0 | 9 | 0 | ″ | 16 | 6 |
| 1855 | 23 | 6 | ″ | 36 | 0 | 16 | 0 | ″ | 25 | 0 | 10 | 0 | ″ | 17 | 0 |
| 1856 | 22 | 0 | ″ | 35 | 6 | 15 | 6 | ″ | 24 | 0 | 10 | 0 | ″ | 15 | 0 |
| 1857 | 24 | 0 | ″ | 36 | 0 | 14 | 6 | ″ | 26 | 0 | 10 | 6 | ″ | 14 | 6 |
| 1858 | 24 | 0 | ″ | 34 | 6 | 14 | 0 | ″ | 24 | 6 | 10 | 6 | ″ | 14 | 0 |
| 1859 | 25 | 0 | ″ | 34 | 6 | 16 | 0 | ″ | 25 | 0 | 10 | 3 | ″ | 14 | 9 |
| 1860 | 26 | 0 | ″ | 38 | 0 | 17 | 6 | ″ | 27 | 6 | 12 | 6 | ″ | 17 | 6 |
| 1861 | 25 | 0 | ″ | 38 | 6 | 16 | 0 | ″ | 28 | 0 | 9 | 0 | ″ | 16 | 0 |
| 1862 | 27 | 0 | ″ | 37 | 6 | 17 | 6 | ″ | 28 | 0 | 10 | 0 | ″ | 16 | 0 |
| 1863 | 25 | 0 | ″ | 38 | 6 | 19 | 0 | ″ | 28 | 6 | 10 | 6 | ″ | 16 | 0 |
| 1864 | 31 | 0 | ″ | 41 | 0 | 21 | 0 | ″ | 31 | 6 | 14 | 0 | ″ | 18 | 0 |
| 1865 | 32 | 6 | ″ | 44 | 0 | 22 | 6 | ″ | 33 | 6 | 14 | 6 | ″ | 20 | 0 |
| 1866 | 37 | 0 | ″ | 50 | 0 | 29 | 0 | ″ | 42 | 6 | 15 | 0 | ″ | 26 | 0 |
| 1867 | 26 | 0 | ″ | 58 | 0 | 18 | 0 | ″ | 25 | 6 | 12 | 0 | ″ | 16 | 0 |
| 1868 | 30 | 0 | ″ | 32 | 0 | 15 | 6 | ″ | 21 | 0 | 7 | 6 | ″ | 13 | 0 |
| 1869 | 28 | 0 | ″ | 38 | 0 | 15 | 0 | ″ | 22 | 6 | 7 | 6 | ″ | 14 | 0 |
| 1870 | 35 | 6 | ″ | 43 | 0 | 18 | 0 | ″ | 28 | 0 | 10 | 0 | ″ | 17 | 0 |
| 1871 | 36 | 6 | ″ | 49 | 0 | 22 | 0 | ″ | 38 | 6 | 14 | 0 | ″ | 20 | 0 |
| 1872 | 45 | 0 | ″ | 56 | 0 | 32 | 0 | ″ | 42 | 0 | 16 | 0 | ″ | 22 | 0 |
| 1873 | 42 | 0 | ″ | 51 | 0 | 25 | 0 | ″ | 42 | 0 | 15 | 6 | ″ | 22 | 0 |
| 1874 | 33 | 6 | ″ | 44 | 6 | 21 | 0 | ″ | 36 | 0 | 12 | 0 | ″ | 17 | 0 |
| 1875 | 33 | 0 | ″ | 48 | 6 | 21 | 0 | ″ | 34 | 0 | 13 | 6 | ″ | 23 | 6 |
| 1876 | 40 | 0 | ″ | 52 | 6 | 23 | 0 | ″ | 30 | 0 | 13 | 6 | ″ | 25 | 0 |
| 1877 | 41 | 0 | ″ | 51 | 0 | 25 | 0 | ″ | 37 | 0 | 15 | 0 | ″ | 24 | 0 |
| 1878 | 35 | 6 | ″ | 48 | 0 | 23 | 6 | ″ | 35 | 0 | 14 | 0 | ″ | 22 | 0 |
| 1879 | 34 | 0 | ″ | 44 | 0 | 21 | 0 | ″ | 34 | 0 | 14 | 0 | ″ | 20 | 0 |
| 1880 | 30 | 0 | ″ | 43 | 6 | 20 | 0 | ″ | 30 | 0 | 12 | 6 | ″ | 20 | 0 |
| 1881 | 32 | 0 | ″ | 45 | 6 | 29 | 0 | ″ | 34 | 0 | 14 | 0 | ″ | 20 | 0 |
| 1882 | 40 | 0 | ″ | 51 | 0 | 30 | 0 | ″ | 40 | 0 | 14 | 0 | ″ | 20 | 6 |
| 1883 | 44 | 0 | ″ | 55 | 6 | 34 | 6 | ″ | 46 | 6 | 15 | 6 | ″ | 23 | 0 |
| 1884 | 36 | 0 | ″ | 47 | 6 | 29 | 6 | ″ | 41 | 6 | 12 | 6 | ″ | 20 | 0 |
| 1885 | 30 | 0 | ″ | 38 | 0 | 24 | 0 | ″ | 31 | 0 | 12 | 0 | ″ | 18 | 0 |

## Table No. 1.—CHEVIOT SHEEP—*Continued.*

| Year. | Wethers. | Ewes | Lambs |
|---|---|---|---|
| | *s d* to *s. d.* | *s d* to *s d* | *s d* to *s d* |
| 1886 | 32 0 to 40 0 | 21 0 to 29 0 | 12 6 to 19 0 |
| 1887 | 29 0 ″ 36 0 | 18 0 ″ 26 0 | 11 0 ″ 16 6 |
| 1888 | 30 0 ″ 38 0 | 19 0 ″ 27 0 | 12 0 ″ 17 6 |
| 1889 | 36 0 ″ 44 0 | 24 0 ″ 32 0 | 14 0 ″ 22 0 |
| 1890 | 31 0 ″ 40 0 | 22 0 ″ 30 0 | 12 6 ″ 20 0 |
| 1891 | 27 0 ″ 38 0 | 16 0 ″ 25 0 | 9 0 ″ 16 0 |
| 1892 | 22 0 ″ 30 6 | 13 0 ″ 22 0 | 5 0 ″ 11 0 |
| 1893 | 26 0 ″ 35 6 | 18 0 ″ 28 6 | 8 6 ″ 15 0 |
| 1894 | 26 0 ″ 37 0 | 20 0 ″ 31 0 | 10 6 ″ 18 6 |
| 1895 | 28 0 ″ 39 0 | 22 0 ″ 34 0 | 11 6 ″ 19 6 |
| 1896 | 24 6 ″ 34 0 | 19 0 ″ 30 6 | 9 0 ″ 16 6 |
| 1897 | 27 0 ″ 36 0 | 21 0 ″ 31 6 | 11 0 ″ 17 6 |
| 1898 | 27 0 ″ 37 0 | 22 0 ″ 32 6 | 12 0 ″ 18 6 |
| 1899 | 24 0 ″ 33 0 | 20 0 ″ 30 6 | 10 6 ″ 16 0 |
| 1900 | 26 0 ″ 36 0 | 22 0 ″ 32 6 | 12 0 ″ 17 0 |
| 1901 | 25 0 ″ 32 6 | 20 0 ″ 29 6 | 11 0 ″ 16 0 |
| 1902 | 24 0 ″ 31 6 | 18 0 ″ 27 0 | 9 6 ″ 14 6 |
| 1903 | 26 0 ″ 34 0 | 21 0 ″ 31 0 | 11 4 ″ 18 0 |
| 1904 | 28 6 ″ 36 6 | 23 0 ″ 32 6 | 13 0 ″ 20 0 |

## Table No. 2—BLACKFACED SHEEP.

| Year | Wethers | Ewes | Lambs |
|---|---|---|---|
| | *s d* to *s d* | *s d* to *s d* | *s. d* to *s d* |
| 1819 | 22 0 to 24 0 | 12 0 to 15 0 | 8 0 to 9 0 |
| 1820 | 20 0 ″ 23 3 | 15 6 ″ 17 0 | 7 0 ″ 8 6 |
| 1821 | 18 0 ″ 20 0 | 12 0 ″ 13 0 | 6 0 ″ 7 0 |
| 1822 | 11 6 ″ 13 6 | 5 6 ″ 6 0 | 4 6 ″ 0 0 |
| 1823 | 12 0 ″ 16 0 | 5 0 ″ 6 6 | 4 0 ″ 5 3 |
| 1824 | 9 6 ″ 13 6 | 6 0 ″ 7 0 | 4 0 ″ 5 0 |
| 1825 | 22 0 ″ 26 0 | 11 0 ″ 13 6 | 6 0 ″ 9 0 |
| 1826 | 15 0 ″ 17 0 | 8 0 ″ 9 0 | 4 6 ″ 6 0 |
| 1827 | 14 0 ″ 18 6 | 7 0 ″ 10 0 | 6 0 ″ 7 6 |
| 1828 | 15 0 ″ 20 0 | 8 0 ″ 11 0 | 5 0 ″ 7 6 |
| 1829 | 14 0 ″ 18 0 | 9 0 ″ 10 0 | 6 0 ″ 7 0 |
| 1830 | 9 6 ″ 13 0 | 4 0 ″ 6 0 | 4 6 ″ 6 0 |
| 1831 | 13 0 ″ 17 0 | 5 0 ″ 7 6 | 5 0 ″ 6 6 |
| 1832 | 14 0 ″ 18 0 | 7 0 ″ 11 6 | 6 0 ″ 7 8 |
| 1833 | 16 0 ″ 24 0 | 7 6 ″ 12 0 | 6 6 ″ 9 0 |
| 1834 | 16 0 ″ 22 0 | 10 0 ″ 13 0 | 6 0 ″ 8 6 |
| 1835 | 15 0 ″ 18 9 | 10 0 ″ 13 0 | 7 0 ″ 8 0 |
| 1836 | 15 0 ″ 21 0 | 9 0 ″ 12 0 | 8 6 ″ 11 0 |
| 1837 | 13 0 ″ 16 0 | 8 0 ″ 12 0 | 8 0 ″ 9 6 |
| 1838 | 15 0 ″ 20 6 | 10 0 ″ 13 0 | not quoted |
| 1839 | 15 0 ″ 22 0 | 10 0 ″ 12 0 | 7 0 to 8 3 |
| 1840 | 15 0 ″ 22 6 | 11 0 ″ 12 0 | 7 0 ″ 9 3 |
| 1841 | 16 0 ″ 20 0 | 9 0 ″ 11 0 | 6 0 ″ 8 0 |
| 1842 | 14 0 ″ 19 0 | 7 6 ″ 8 0 | 5 6 ″ 7 0 |
| 1843 | not quoted | 4 9 ″ 6 6 | not quoted |
| 1844 | 15 0 to 21 0 | 6 6 ″ 10 0 | 5 0 to 8 0 |
| 1845 | 14 0 ″ 23 0 | 8 0 ″ 12 0 | 6 0 ″ 8 0 |
| 1846 | 13 0 ″ 24 0 | 10 0 ″ 13 0 | 8 0 ″ 9 0 |
| 1847 | 20 6 ″ 25 0 | 10 0 ″ 14 0 | 8 6 ″ 9 6 |
| 1848 | 20 0 ″ 24 0 | 11 3 ″ 12 0 | 8 6 ″ 10 0 |
| 1849 | not quoted. | not quoted | 7 0 ″ 7 6 |
| 1850 | . | . | 7 0 ″ 0 0 |
| 1851 | 17 6 to 23 0 | 9 0 to 12 0 | 6 6 ″ 8 0 |
| 1852 | 18 6 ″ 22 0 | 9 6 ″ 12 0 | 4 6 ″ 7 9 |
| 1853 | 23 0 ″ 27 0 | 14 6 ″ 16 6 | 8 0 ″ 11 6 |
| 1854 | 20 0 ″ 26 0 | 11 0 ″ 16 6 | 8 0 ″ 10 6 |
| 1855 | 23 6 ″ 26 6 | 14 0 ″ 16 0 | 10 0 ″ 11 0 |
| 1856 | 17 0 ″ 24 0 | 10 0 ″ 20 0 | 7 6 ″ 10 0 |
| 1857 | 20 0 ″ 29 0 | 10 6 ″ 15 0 | 9 3 ″ 11 0 |
| 1858 | 20 0 ″ 27 6 | 9 9 ″ 18 9 | 8 3 ″ 10 6 |
| 1859 | 20 0 ″ 25 0 | 10 0 ″ 14 0 | 8 9 ″ 11 0 |
| 1860 | 21 0 ″ 27 3 | 11 0 ″ 16 0 | 10 0 ″ 13 6 |
| 1861 | 21 0 ″ 29 0 | 12 0 ″ 22 0 | 6 3 ″ 14 0 |

**Table No. 2.—BLACKFACED SHEEP—*Continued.***

| Year | Wethers | | | | | Ewes. | | | | | Lambs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s. | d. | | s. | d. | s | d | | s | d. | s | d | | s | d |
| 1862 | 16 | 9 | to | 27 | 0 | 12 | 0 | to | 13 | 3 | 6 | 0 | to | 12 | 0 |
| 1863 | 20 | 0 | " | 30 | 6 | 13 | 0 | " | 16 | 0 | 8 | 0 | " | 11 | 6 |
| 1864 | 25 | 0 | " | 30 | 0 | 15 | 0 | " | 19 | 0 | 10 | 0 | " | 13 | 6 |
| 1865 | 15 | 6 | " | 32 | 6 | 15 | 0 | " | 25 | 0 | 10 | 0 | " | 17 | 0 |
| 1866 | 31 | 6 | " | 40 | 0 | 20 | 0 | " | 36 | 0 | 13 | 6 | " | 22 | 6 |
| 1867 | 20 | 0 | " | 30 | 6 | 14 | 0 | " | 22 | 0 | 7 | 6 | " | 13 | 6 |
| 1868 | 20 | 0 | " | 26 | 0 | 10 | 6 | " | 13 | 6 | 7 | 0 | " | 13 | 0 |
| 1869 | 22 | 0 | " | 28 | 0 | 11 | 0 | " | 14 | 0 | 6 | 9 | " | 9 | 0 |
| 1870 | 27 | 0 | " | 32 | 6 | 18 | 0 | " | 22 | 0 | 8 | 0 | " | 14 | 6 |
| 1871 | 23 | 0 | " | 37 | 0 | 13 | 0 | " | 23 | 0 | 11 | 0 | " | 16 | 3 |
| 1872 | 31 | 6 | " | 45 | 0 | 18 | 0 | " | 32 | 0 | 12 | 6 | " | 18 | 0 |
| 1873 | 28 | 0 | " | 39 | 0 | 16 | 6 | " | 27 | 0 | 7 | 0 | " | 16 | 0 |
| 1874 | 25 | 0 | " | 35 | 0 | 13 | 0 | " | 20 | 0 | 7 | 0 | " | 14 | 0 |
| 1875 | 26 | 6 | " | 37 | 6 | 15 | 0 | " | 21 | 3 | 9 | 6 | " | 17 | 6 |
| 1876 | 30 | 0 | " | 40 | 0 | 19 | 0 | " | 24 | 0 | 13 | 0 | " | 20 | 6 |
| 1877 | 35 | 0 | " | 38 | 9 | 18 | 0 | " | 25 | 0 | 13 | 6 | " | 23 | 0 |
| 1878 | 30 | 0 | " | 36 | 0 | 17 | 0 | " | 23 | 0 | 12 | 0 | " | 22 | 0 |
| 1879 | 25 | 0 | " | 35 | 9 | 16 | 0 | " | 24 | 0 | 10 | 6 | " | 20 | 0 |
| 1880 | 25 | 0 | " | 38 | 0 | 16 | 6 | " | 22 | 6 | 10 | 0 | " | 17 | 0 |
| 1881 | 30 | 0 | " | 39 | 0 | 15 | 0 | " | 23 | 0 | 10 | 0 | " | 15 | 0 |
| 1882 | 33 | 0 | " | 46 | 0 | 20 | 0 | " | 28 | 0 | 12 | 6 | " | 18 | 6 |
| 1883 | 36 | 0 | " | 50 | 6 | 24 | 6 | " | 33 | 0 | 14 | 0 | " | 21 | 6 |
| 1884 | 29 | 0 | " | 43 | 6 | 19 | 6 | " | 28 | 0 | 12 | 0 | " | 19 | 6 |
| 1885 | 24 | 0 | " | 34 | 0 | 13 | 0 | " | 22 | 6 | 10 | 0 | " | 15 | 0 |
| 1886 | 25 | 0 | " | 34 | 0 | 12 | 0 | " | 22 | 0 | 10 | 6 | " | 16 | 0 |
| 1887 | 22 | 0 | " | 30 | 0 | 11 | 0 | " | 19 | 0 | 8 | 0 | " | 13 | 0 |
| 1888 | 22 | 0 | " | 32 | 0 | 13 | 0 | " | 24 | 0 | 10 | 0 | " | 15 | 0 |
| 1889 | 26 | 0 | " | 40 | 0 | 18 | 0 | " | 29 | 0 | 13 | 0 | " | 22 | 0 |
| 1890 | 24 | 0 | " | 37 | 0 | 14 | 0 | " | 27 | 0 | 10 | 6 | " | 19 | 0 |
| 1891 | 21 | 0 | " | 37 | 0 | 10 | 0 | " | 24 | 0 | 7 | 6 | " | 15 | 0 |
| 1892 | 16 | 0 | " | 28 | 6 | 6 | 0 | " | 17 | 0 | 8 | 0 | " | 10 | 0 |
| 1893 | 21 | 0 | " | 37 | 0 | 12 | 0 | " | 24 | 0 | 7 | 0 | " | 14 | 6 |
| 1894 | 20 | 0 | " | 37 | 6 | 14 | 6 | " | 26 | 6 | 8 | 6 | " | 16 | 0 |
| 1895 | 23 | 0 | " | 41 | 0 | 16 | 0 | " | 28 | 6 | 9 | 0 | " | 17 | 0 |
| 1896 | 19 | 0 | " | 35 | 4 | 13 | 0 | " | 24 | 0 | 6 | 0 | " | 13 | 6 |
| 1897 | 21 | 0 | " | 36 | 6 | 15 | 0 | " | 25 | 6 | 7 | 0 | " | 14 | 6 |
| 1898 | 22 | 0 | " | 37 | 0 | 16 | 0 | " | 26 | 6 | 8 | 0 | " | 15 | 0 |
| 1899 | 20 | 0 | " | 33 | 6 | 13 | 0 | " | 24 | 0 | 5 | 6 | " | 13 | 0 |
| 1900 | 23 | 0 | " | 36 | 0 | 16 | 0 | " | 26 | 6 | 8 | 0 | " | 15 | 6 |
| 1901 | 20 | 0 | " | 35 | 0 | 14 | 0 | " | 25 | 6 | 6 | 6 | " | 14 | 6 |
| 1902 | 18 | 6 | " | 34 | 0 | 12 | 0 | " | 24 | 0 | 6 | 0 | " | 14 | 0 |
| 1903 | 21 | 0 | " | 36 | 0 | 15 | 0 | " | 28 | 0 | 7 | 0 | " | 16 | 6 |
| 1904 | 23 | 0 | " | 38 | 6 | 18 | 0 | " | 30 | 0 | 8 | 6 | " | 17 | 6 |

| Year. | Laid Cheviot | | | | | White Cheviot | | | | | Laid Highland | | | | | White Highland | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s | d | | s | d | s | d | | s. | d | s | d | | s | d | s | d | | s | d |
| 1818 | 40 | 0 | to | 42 | 2 | | | . | | | 20 | 0 | to | 22 | 6 | | | . | | |
| 1819 | 21 | 0 | " | 22 | 0 | | | .. | | | 10 | 0 | " | 10 | 3 | | | . | | |
| 1820 | 20 | 0 | " | 22 | 0 | | | .. | | | 9 | 0 | " | 10 | 0 | | | | | |
| 1821 | 18 | 0 | " | 20 | 0 | | | .. | | | 9 | 0 | " | 10 | 0 | | | . | | |
| 1822 | 12 | 6 | " | 14 | 6 | | | .. | | | 5 | 0 | " | 6 | 6 | | | | | |
| 1823 | 9 | 0 | " | 10 | 6 | | | | | | 5 | 0 | " | 5 | 9 | | | . | | |
| 1824 | 13 | 6 | " | 15 | 0 | | | .. | | | 6 | 0 | " | 6 | 3 | | | .. | | |
| 1825 | 10 | 6 | " | 22 | 0 | | | | | | 10 | 0 | " | 10 | 6 | | | | | |
| 1826 | 11 | 0 | " | 14 | 0 | | | . | | | 5 | 0 | " | 5 | 6 | | | .. | | |
| 1827 | 11 | 0 | " | 14 | 0 | | | .. | | | 5 | 6 | " | 6 | 9 | | | . | | |
| 1828 | 8 | 0 | " | 11 | 0 | | | .. | | | 5 | 6 | " | 6 | 0 | | | | | |
| 1829 | 8 | 6 | " | 11 | 0 | | | .. | | | 4 | 3 | " | 0 | 0 | | | | | |
| 1830 | 9 | 6 | " | 11 | 0 | | | .. | | | 4 | 6 | " | 5 | 0 | | | | | |
| 1831 | 17 | 0 | " | 20 | 0 | | | .. | | | 7 | 6 | " | 8 | 6 | | | | | |
| 1832 | 14 | 0 | " | 16 | 0 | | | .. | | | 7 | 0 | " | 7 | 6 | | | | | |
| 1833 | 18 | 0 | " | 20 | 7 | | | .. | | | 10 | 0 | " | 11 | 0 | | | .. | | |
| 1834 | 21 | 0 | " | 24 | 6 | | | . | | | 5 | 6 | " | 7 | 0 | | | .. | | |
| 1835 | 19 | 0 | " | 20 | 6 | | | . | | | 9 | 6 | " | 10 | 8 | | | | | |
| 1836 | 21 | 0 | " | 25 | 0 | | | .. | | | 10 | 0 | " | 14 | 0 | | | . | | |

## TABLE No. 3.—PRICE OF WOOL—*Continued.*

| Year | Laid Cheviot | White Cheviot | Laid Highland | White Highland. |
|---|---|---|---|---|
| | s d s d | s d s d | s d s. d | s d s d |
| 1837 | 12 0 to 14 0 | . | 7 0 to 7 8 | . |
| 1838 | 19 0 " 22 6 | | 6 0 " 10 0 | . |
| 1839 | 18 0 " 20 0 | | 8 0 " 12 0 | .. |
| 1840 | 15 0 " 0 0 | . | 7 0 " 0 0 | . |
| 1841 | 15 0 " 16 9 | | 6 0 " 7 5 | |
| 1842 | 12 6 " 14 0 | .. | not quoted | |
| 1843 | 9 0 " 11 6 | | 5 0 to 6 0 | |
| 1844 | 15 0 " 18 0 | | not quoted | .. |
| 1845 | 14 6 " 17 6 | | 7 6 to 8 6 | |
| 1846 | 12 0 " 14 6 | | 8 0 " 8 6 | |
| 1847 | 12 6 " 14 0 | | not quoted | |
| 1848 | 9 6 " 11 0 | | 4 9 to 0 0 | |
| 1849 | 12 0 " 16 6 | | 6 0 " 6 3 | |
| 1850 | 15 0 " 17 6 | | 8 0 " 8 6 | |
| 1851 | 12 0 " 16 0 | | 8 0 " 9 3 | . |
| 1852 | 13 0 " 15 0 | | 8 0 " 9 0 | |
| 1853 | 19 0 " 22 0 | | 11 0 " 12 6 | |
| 1854 | 12 0 " 15 0 | | 7 6 " 8 6 | |
| 1855 | 14 6 " 19 0 | | 8 6 " 9 0 | .. |
| 1856 | 19 0 " 21 6 | | 11 0 " 0 0 | .. |
| 1857 | 19 0 " 24 0 | | 13 0 " 14 3 | |
| 1858 | 15 0 " 17 0 | .. | 8 9 " 10 0 | |
| 1859 | 18 6 " 24 0 | | 10 9 " 11 6 | |
| 1860 | 22 0 " 32 0 | 37 0 to 38 0 | 10 0 " 11 3 | .. |
| 1861 | 19 6 " 27 0 | from 30s upwards | not quoted | |
| 1862 | 18 6 " 26 0 | 30 0 to 37 0 | 11 6 to 16 0 | |
| 1863 | 25 6 " 31 0 | 38 0 " 42 0 | 15 3 " 17 6 | . |
| 1864 | 31 0 " 39 0 | 47 0 " 54 0 | 17 6 " 20 0 | |
| 1865 | 23 0 " 30 0 | 44 0 " 45 0 | 15 0 " 17 0 | |
| 1866 | 24 0 " 30 0 | 30 0 " 38 0 | 14 0 " 16 0 | |
| 1867 | 16 0 " 21 6 | not quoted | not quoted | |
| 1868 | 19 0 " 26 0 | 28 0 to 32 0 | 8 6 to 9 0 | |
| 1869 | 18 0 " 26 6 | not quoted | 8 6 " 10 0 | |
| 1870 | 15 0 " 23 6 | 25 0 to 26 0 | 9 6 " 0 0 | |
| 1871 | 20 0 " 26 6 | 30 0 " 34 6 | 12 0 " 15 0 | |
| 1872 | 26 0 " 37 6 | 40 0 " 48 0 | 18 0 " 21 0 | |
| 1873 | 17 0 " 18 0 | 34 0 " 40 0 | 9 0 " 12 0 | |
| 1874 | 18 6 " 26 6 | 30 0 " 34 0 | 9 6 " 13 0 | |
| 1875 | 25 0 " 32 0 | 34 6 " 36 0 | 12 6 " 16 0 | |
| 1876 | 20 0 " 24 0 | 30 0 " 34 6 | 9 6 " 12 0 | . |
| 1877 | 20 9 " 26 0 | 28 0 " 30 0 | 10 0 " 12 0 | |
| 1878 | 18 9 " 25 0 | 27 0 " 32 0 | 8 6 " 11 6 | . |
| 1879 | 15 0 " 17 0 | prices very low | 7 0 " 0 0 | . |
| 1880 | 20 0 " 24 0 | 30 0 to 32 0 | 10 6 " 11 6 | 14 0 to 15 0 |
| 1881 | 17 0 " 21 0 | 27 0 " 30 0 | 5 0 " 9 6 | 12 0 " 13 0 |
| 1882 | 14 0 " 18 0 | 27 6 " 28 0 | 7 6 " 9 0 | 13 0 " 14 0 |
| 1883 | 13 0 " 18 0 | 26 0 " 28 0 | 6 6 " 8 6 | 11 6 " 12 6 |
| 1884 | 13 0 " 18 0 | 26 0 " 28 0 | 6 6 " 8 6 | 11 6 " 12 6 |
| 1885 | 12 0 " 17 0 | 22 6 " 26 0 | 6 0 " 8 0 | 11 6 " 12 0 |
| 1886 | 13 0 " 18 0 | 23 0 " 27 6 | 6 6 " 8 6 | 11 6 " 12 0 |
| 1887 | 14 0 " 22 0 | 23 0 " 28 0 | 7 0 " 9 0 | 11 6 " 13 0 |
| 1888 | 13 0 " 20 0 | 23 0 " 28 0 | 7 0 " 9 0 | 11 0 " 12 6 |
| 1889 | 13 0 " 18 0 | 24 0 " 28 0 | 7 0 " 9 0 | 11 0 " 12 6 |
| 1890 | 13 0 " 18 0 | 24 0 " 28 0 | 7 0 " 9 0 | 11 0 " 12 6 |
| 1891 | 12 6 " 18 0 | 22 0 " 28 0 | 7 0 " 9 0 | 11 0 " 12 6 |
| 1892 | 12 0 " 18 0 | 20 0 " 28 0 | 7 0 " 8 6 | 10 6 " 12 0 |
| 1893 | 12 0 " 17 0 | 20 0 " 27 0 | 7 0 " 8 0 | 10 0 " 12 0 |
| 1894 | 12 0 " 16 0 | 20 0 " 26 0 | 7 0 " 8 0 | 10 0 " 12 0 |
| 1895 | 12 0 " 16 0 | 20 0 " 25 0 | 7 0 " 8 0 | 10 0 " 11 6 |
| 1896 | 11 0 " 15 0 | 19 0 " 24 0 | 7 0 " 8 0 | 10 0 " 11 6 |
| 1897 | 11 0 " 14 0 | 18 0 " 23 0 | 7 0 " 8 0 | 10 6 " 12 0 |
| 1898 | 10 0 " 13 0 | 16 0 " 20 0 | 7 0 " 8 0 | 10 0 " 11 6 |
| 1899 | 10 0 " 13 0 | 13 0 " 18 6 | 7 0 " 8 0 | 8 6 " 9 6 |
| 1900 | 9 9 " 12 0 | 13 0 " 18 6 | 6 9 " 7 9 | 8 0 " 9 6 |
| 1901 | 9 0 " 10 0 | 11 0 " 16 6 | 5 9 " 6 6 | 8 0 " 9 0 |
| 1902 | 9 0 " 10 0 | 11 6 " 17 0 | 6 0 " 6 6 | 8 6 " 9 6 |
| 1903 | 10 0 " 12 0 | 15 0 " 18 0 | 7 0 " 8 0 | 11 6 " 12 6 |
| 1904 | 15 0 " 17 6 | 20 0 " 21 0 | 9 0 " 10 0 | 14 0 " 15 0 |

# GENERAL SHOW AT PERTH, 1904.

THE Society has had few more successful Shows than that which took place at Perth on the 19th, 20th, 21st, and 22nd July 1904. The South Inch, given free of charge, along with a supply of water, by the city of Perth, formed an ideal showyard in every way. The counties in the district raised a local fund of £1118, and on all hands the Society received cordial support in carrying through the Show. The weather was favourable, the public attended in large numbers, and the Treasurer's accounts showed a credit balance of about £1830.

The entries of live stock were large in almost all sections, and, with regard to quality, a higher standard has rarely been reached. This was true of all the leading breeds of farm live stock kept in Scotland.

The collection of implements and machines was not only exceptionally extensive, but of the highest merit and interest.

## *Statistics.*

The following tables give the number of entries in the various sections.—

### I. CATTLE.

| Class. | | No. of Entries | |
|---|---|---|---|
| | SHORTHORN. | | |
| 1. | Aged bulls | 13 | |
| 2. | Two-year-old bulls | 17 | |
| 3 | One-year-old bulls | 16 | |
| 4 | Cows of any age | 13 | |
| 5 | Two-year-old heifers | 13 | |
| 6. | One-year-old heifers | 19 | |
| | | — | 91 |
| | ABERDEEN-ANGUS | | |
| 7. | Aged bulls | 12 | |
| 8 | Two-year-old bulls | 13 | |
| 9. | One-year-old bulls | 10 | |
| 10 | Cows of any age | 12 | |
| 11 | Two-year-old heifers | 10 | |
| 12 | One-year-old heifers | 27 | |
| | Extra stock | 3 | |
| | | — | 87 |
| | GALLOWAY | | |
| 13. | Aged bulls | 3 | |
| 14. | Two-year-old bulls | 2 | |
| 15. | One-year-old bulls | 6 | |
| 16. | Cows of any age | 9 | |
| 17. | Two-year-old heifers | 11 | |
| 18 | One-year-old heifers | 11 | |
| | | — | 42 |

### Highland

| | | | |
|---|---|---|---|
| 19. | Aged bulls | 9 | |
| 20. | Two-year-old bulls | 8 | |
| 21. | One-year-old bulls | 11 | |
| 22 | Cows of any age | 14 | |
| 23 | Three-year-old heifers | 15 | |
| 24 | Two-year-old heifers | 19 | |
| | | — | 76 |

### Ayrshire.

| | | | |
|---|---|---|---|
| 25. | Aged bulls | 2 | |
| 26. | Two-year-old bulls | 6 | |
| 27. | One-year-old bulls | 4 | |
| 28. | Cows in milk, calved before 1901 | 4 | |
| 29 | Cows in milk, calved after 1st January 1901 | 6 | |
| 30. | Cows of any age, in calf, or heifers in calf, calved in 1901 | 4 | |
| 31. | Two-year-old heifers | 6 | |
| 32. | One-year-old heifers | 6 | |
| | | — | 38 |

### Fat Cattle.

| | | | |
|---|---|---|---|
| 33. | Two-year-old oxen, any pure breed or cross | 6 | |
| 34 | One-year-old oxen, any pure breed or cross | 3 | |
| 35 | Two-year-old heifers, any pure breed or cross | 5 | |
| 36 | One-year-old heifers, any pure breed or cross. (*No Entry*) | | |
| | | — | 14 |
| | | | 348 |

## 2. HORSES

### Draught Stallions

| | | | |
|---|---|---|---|
| 37. | Aged stallions | 14 | |
| 38. | Three-year-old entire colts | 16 | |
| 39. | Two-year-old entire colts | 21 | |
| 40. | One-year-old entire colts | 19 | |
| | | — | 70 |

### Draught Geldings

| | | | |
|---|---|---|---|
| 41. | Aged geldings | 3 | |
| 42 | Three-year-old geldings | 6 | |
| 43. | Two-year-old geldings | 4 | |
| | | — | 13 |

### Draught Mares and Fillies.

| | | | |
|---|---|---|---|
| 44. | Mares with foal at foot | 8 | |
| | Extra stock | 1 | |
| 45 | Yeld mares, foaled before 1901 | 8 | |
| | Extra Stock | 1 | |
| 46. | Three-year-old yeld mares, or fillies | 10 | |
| 47. | Two-year-old fillies | 13 | |
| 48. | One-year-old fillies | 15 | |
| | | — | 56 |

### Hunters.

| | | | |
|---|---|---|---|
| 49. | Colt, gelding, or filly, foaled in 1903, the produce of thoroughbred stallions | 5 | |
| 50. | Filly, mare, or gelding, for field, foaled in 1902—*in hand* | 13 | |
| 51 | Yeld mare, filly, or gelding, for field, foaled in 1901 *in hand* | 5 | |
| 52 | Made hunters, any age, able to carry up to 13 st | 3 | |
| 53. | Made hunters, any age, able to carry over 13 st. | 5 | |
| 54. | Hunter, brood mare, with foal at foot, or to foal this season | 9 | |
| | Extra stock | 1 | |
| | | — | 41 |

### Hackneys.

| | | | |
|---|---|---|---|
| 55. | Brood mares, 15 hands and upwards, with foal at foot, or to foal this season to a registered sire | 5 | |
| 56. | Brood mares, under 15 hands, with foal at foot, or to foal this season to a registered sire | 5 | |

[*Continued on p.* 421.

Fig. 58. Shorthorn Bull "Ro[illegible]"

Winner of [illegible] Medal for best Shorthorn, Perth Show, 1904. The property of His Majesty the King, at the Royal Farms, Windsor. Bred by her late Majesty Queen Victoria. Age three years and six months.

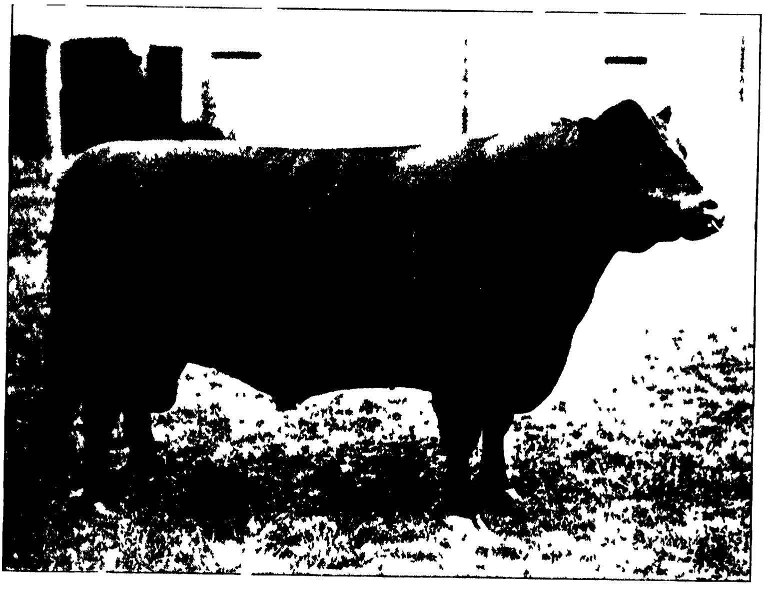


Fig. 59. Aberdeen Angus Bull, "Pundit of Preston" (17,1[illegible]6).

Winner of President's Medal for best Aberdeen Angus animal, Perth Show, 1904. The property of Messrs. C. Perkins & Partners, Burtley, Co. Durham. Bred by Rev. C. B[illegible]lder, Preston Bissett, Buckinghamshire. Age five years.

FIG. 60.—GALLOWAY COW, "ALICE III OF CASTLEMILK" 16867

Winner of Prizes [illegible] Galloway Perth Show 1904. Bred by the late Sir R. [illegible] Jardine [illegible] of Castlemilk [illegible] Age [illegible] months

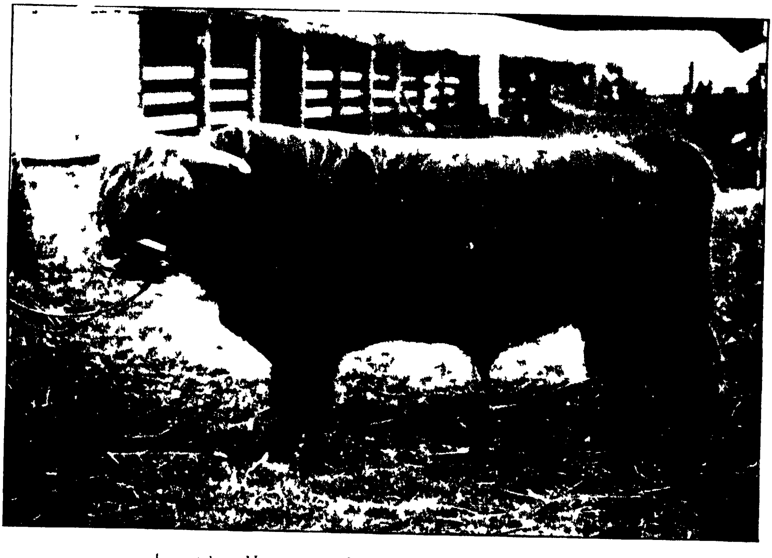


FIG. 61.—HIGHLAND [illegible] 171[illegible]

[illegible] 190[illegible] [illegible]

Fig. 62.—Ayrshire Cow "Ardyne Pride" 14056.

Winner of President's Medal for best Ayrshire, Perth Show, 1904. The property of Dr Char
Douglas, M.P., Auchlochan, Lesmahagow. Bred by Messrs R. & J. M'Alister, Mid Asc
Rothesay. Age six years.

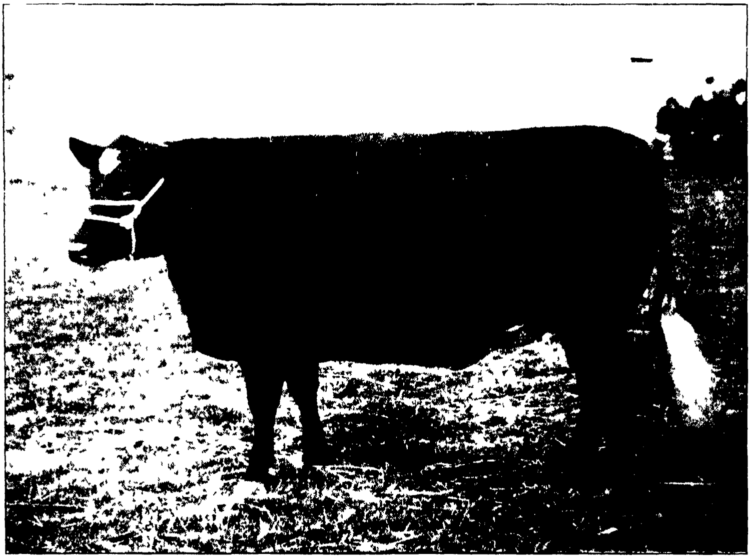


Fig. 63.—Cross-Bred Heifer.

Winner of President's Medal for best Fat animal, Perth Show, 1904. Bred by and the propert
of Mr W. Stewart Menzies of Arndilly, Craigellachie. Age two years and six months.

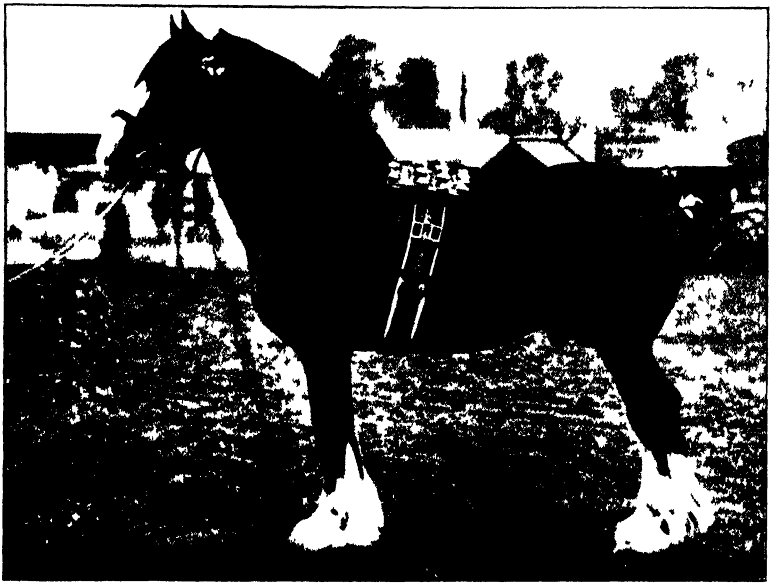
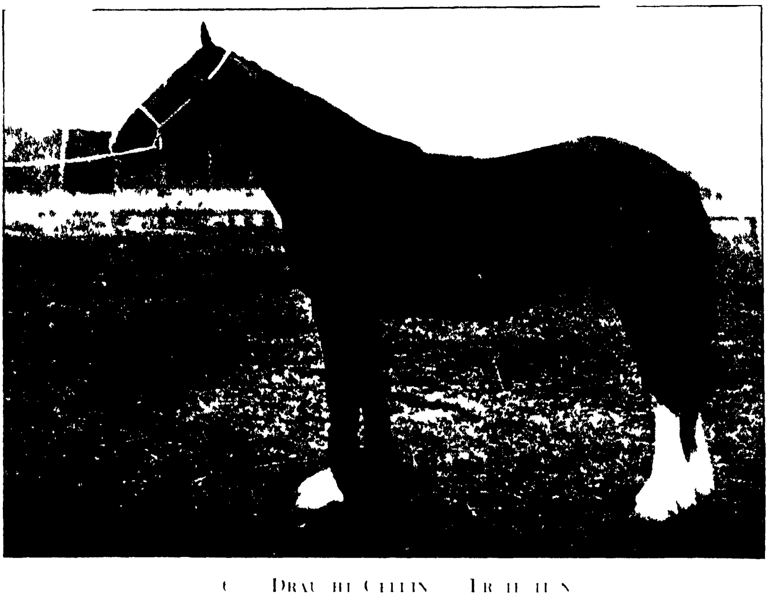


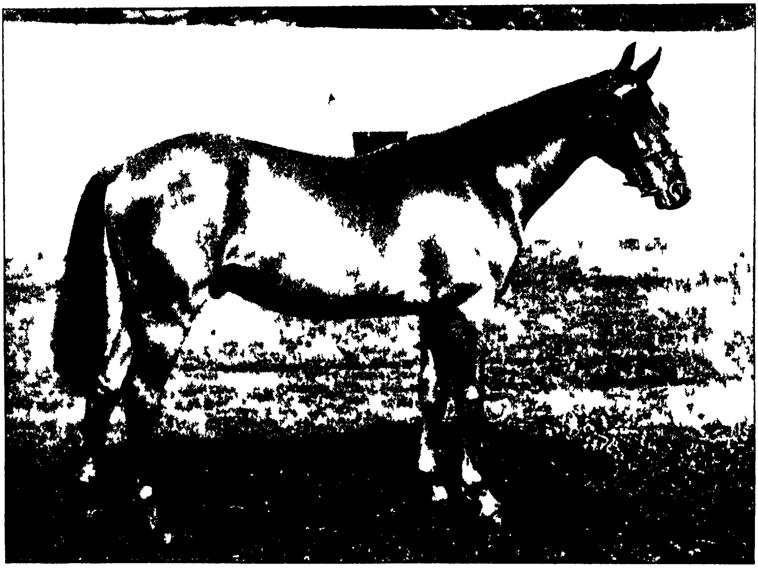
Fig. 64. Clydesdale Stallion [illegible]

[illegible] Stallion [illegible] Colt [illegible] Show [illegible] 04 [illegible]



[illegible] Draught [illegible]

[illegible]



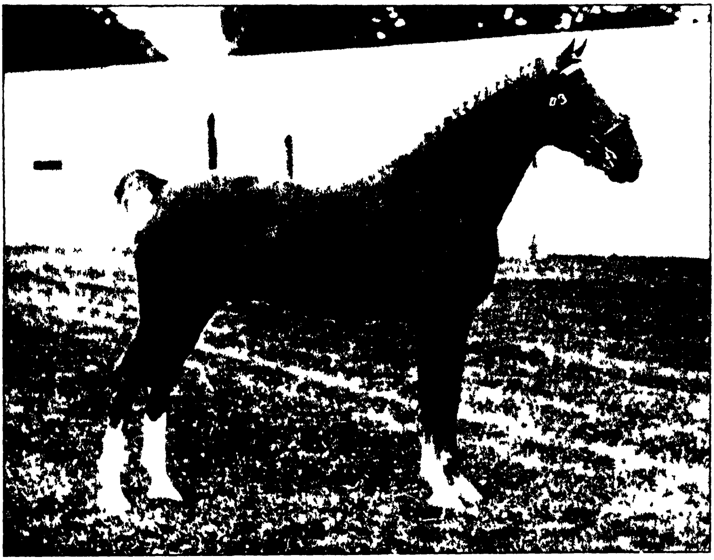


Fig. 68.—Hackney Stallion, "Moncreiffe Vengeance" 8219.*

Winner of President's Medal for best Hackney, Perth Show, 1904. Bred by and the property of Sir Robert Moncreiffe, Bart., Moncreiffe House, Bridge of Earn. Age three years.

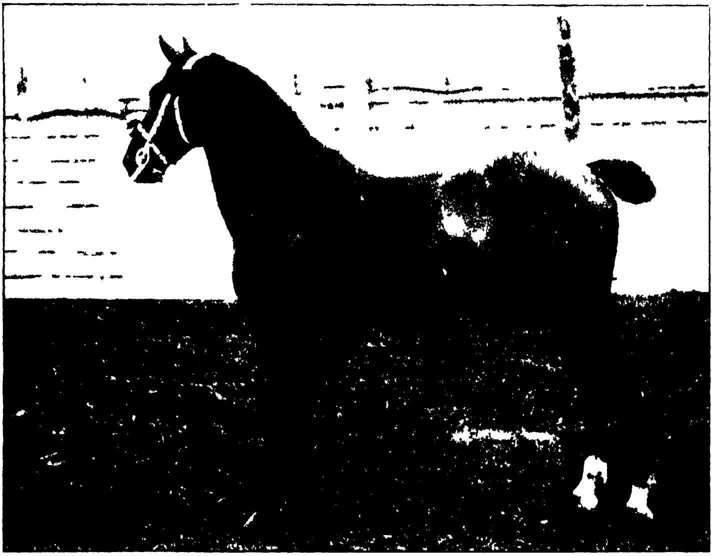


Fig. 69.—Pony Stallion, "Pindlefield's Horace" [illegible]

Winner of President's Medal for best Pony, Perth Show, 1904. The property of Mr. J. Smith, Shirley Stud, Hall Green, near Birmingham. Bred by Mr. T. [illegible], [illegible], Yorkshire. Age four years.

Fig. 70.—Arab Stallion, "Mah[illegible]"

[illegible] ... Royal ... Show ... The property of ... M.V.O., D.S.O., Blair Atholl ... [illegible]

Fig. 71.—Highland Pony Stallion, ... [illegible]

[illegible] ... Highland ... Show ... property of the Duke of Atholl, K.T., Blair Castle, Blair Atholl.

( FIDING IN H

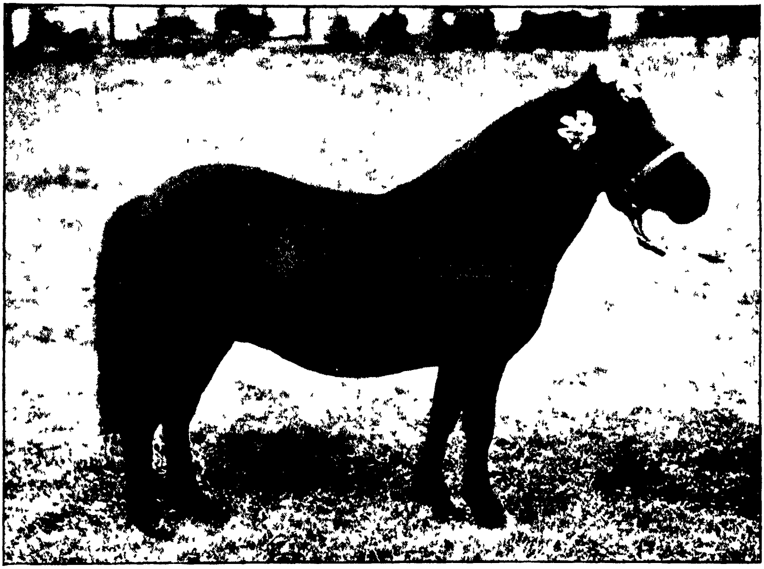
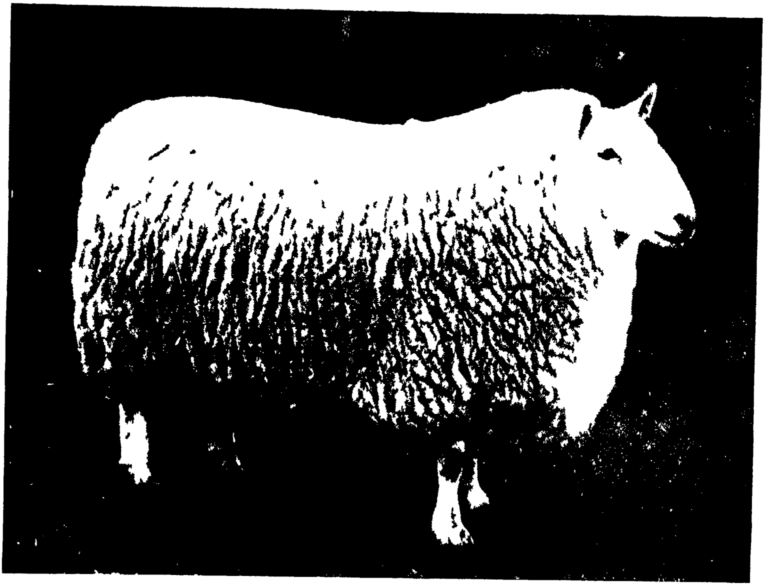


Fig 73 —Shetland Pony Mare, "Strawberry

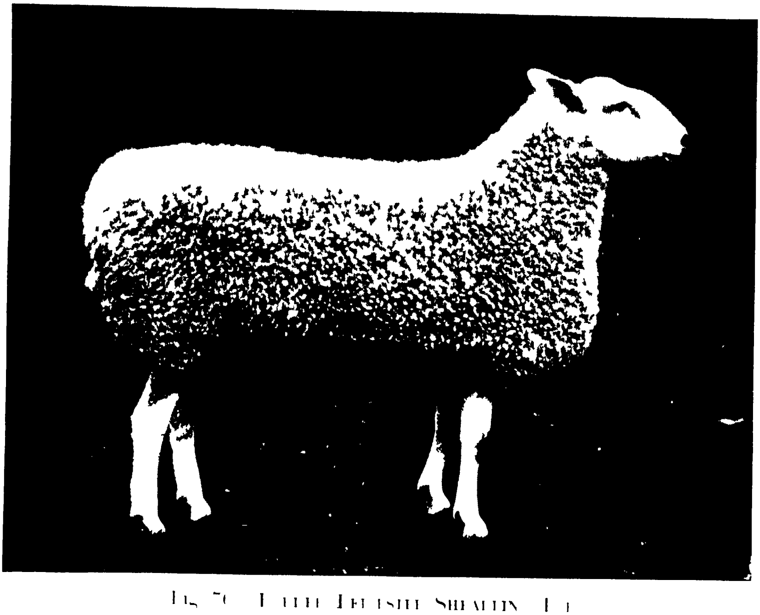
Winner of President's Medal for best Shetland Pony, Perth Show, 1904 The property of Mr Walter Aitchison, Connelaugh, Huntly Bred by the Marquis of Londonderry Age six years

Fig 74 —Blackface Tup

Winner of President's Medal for best Blackface Sheep, Perth Show, 1904 Bred by and the property of Mr J Archibald, Overshiels Stow Age three shear



[illegible]



[illegible]

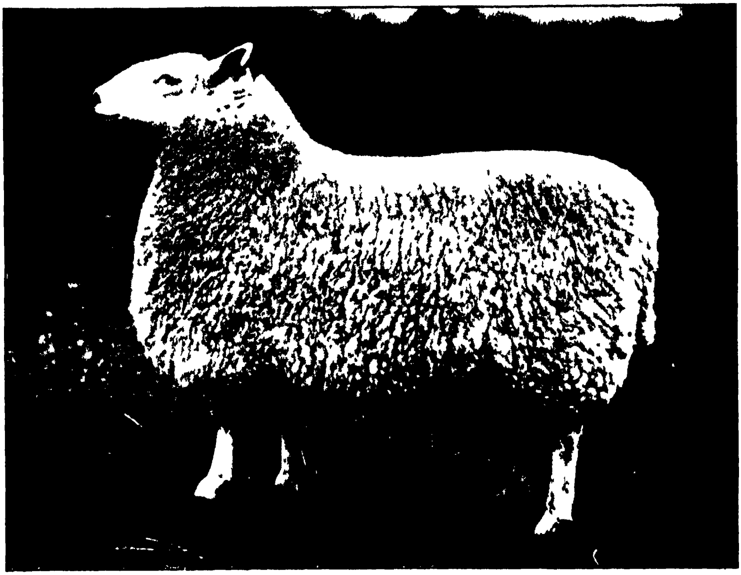


Fig. 77.—Half-bred Shearling Tup.

Winner of President's Medal for best Half-bred, Perth Show, 1904. Bred by and the property of Messrs. A. & J. K. Smith, Leston, Upper Keith.

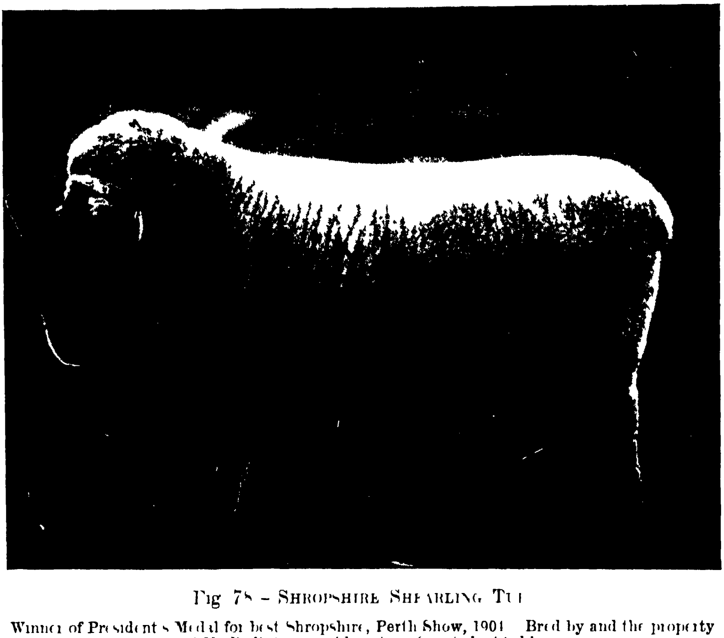


Fig. 78.—Shropshire Shearling Tup.

Winner of President's Medal for best Shropshire, Perth Show, 1904. Bred by and the property of Mr. R. P. Cooper, Shenstone Court, Lichfield.

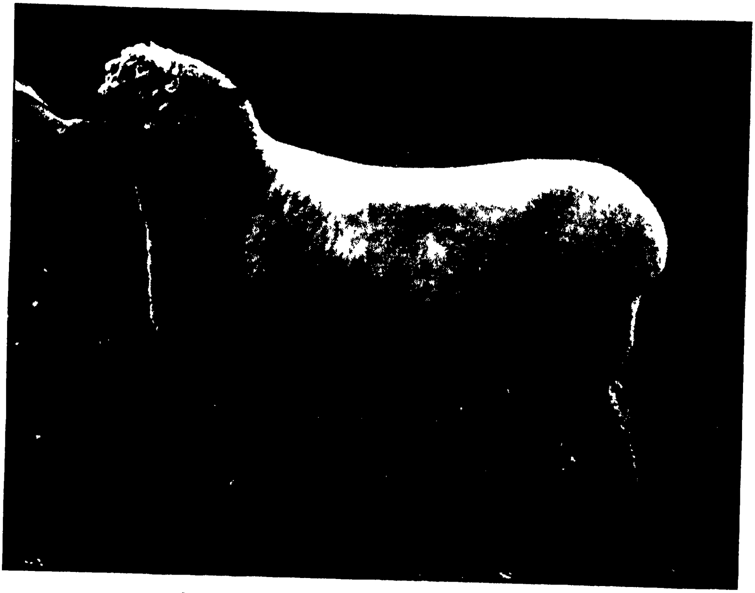


Fig 79.—Oxford Down Shearling Tup

Winner of President's Medal for best Oxford Down, Perth Show, 1904. Bred by and the property of Mr James T Hobbs, Maisey Hampton, Fairford, Gloucester

Fig 80.—Suffolk Shearling Ewe

Winner of President's Medal for best Suffolk, Perth Show, 1904. The property of Mr Alexander Anderson, Berryhill, Dundee. Bred by Lieut Col E W Baird, Exning House, Newmarket

HACKNEYS—*continued.*

| | | |
|---|---|---|
| 57. Yeld mares or fillies, three years old | 3 | |
| 58. Fillies, two years old | 6 | |
| 59. Filly, one year old | 1 | |
| 60. Stallion, foaled in or before 1901, over 15 hands | 1 | |
| 61. Stallion, foaled in or before 1901, over 14 and not over 15 hands | 2 | |
| 62. Entire colts, two years old | 3 | |
| 63. Entire colts, one year old | 3 | |
| Extra stock | 1 | |
| | — | 30 |

PONIES.

| | | |
|---|---|---|
| 64. Stallions, 3 years old and upwards, over 12 and not exceeding 14 hands | 7 | |
| 65 Stallion, 3 years old and upwards, 12 hands and under | 1 | |
| 66. Yeld mares, fillies, or geldings, 3 years old and upwards, over 13 and not over 14 hands | 4 | |
| 67. Yeld mare, filly, or gelding, 3 years old and upwards, over 12 and not over 13 hands | 1 | |
| 68. Yeld mares, fillies, or geldings, 3 years old and upwards, 12 hands and under | 2 | |
| | — | 15 |

POLO AND RIDING PONIES

| | | |
|---|---|---|
| 69. Stallions, 3 years old and upwards, 13·2 and not exceeding 14·2 hands | 5 | |
| Extra stock | 1 | |
| 70 Yeld mares, fillies, or geldings, 3 years old or upwards, 13 2 and not exceeding 14 2 hands | 2 | |
| | — | 8 |

HIGHLAND PONIES

| | | |
|---|---|---|
| 71. Highland pony stallions, 3 years old or upwards, not exceeding 14 2 hands, entered or accepted for entry in the Highland section of the Polo Pony Stud-Book | 4 | |
| 72. Highland pony entire colts, foaled in 1902 or 1903 | 4 | |
| 73. Highland pony mares, 3 years old or upwards, not exceeding 14 2 hands, yeld or with foal at foot, entered or accepted for entry in the Highland section of the Polo Pony Stud Book | 16 | |
| | — | 24 |

SHETLAND PONIES

| | | |
|---|---|---|
| 74. Shetland stallions, not exceeding 10½ hands, foaled before 1901 | 9 | |
| 75 Shetland entire colts, not exceeding 10½ hands, foaled in 1901 or 1902 | 7 | |
| 76. Shetland mares, not exceeding 10½ hands, with foal at foot | 10 | |
| 77. Shetland yeld mares, not exceeding 10½ hands | 8 | |
| 78. Shetland fillies, not exceeding 10½ hands, foaled in 1901 or 1902 | 8 | |
| | — | 42 |

DRIVING COMPETITIONS.

| | | |
|---|---|---|
| 79. Yeld mares, fillies, or geldings, in harness, 15 hands and upwards, | 9 | |
| 80. Yeld mares, fillies, or geldings, in harness, under 15 hands (8) | 7 | |
| | — | 16 |
| | | 315 |

JUMPING.

| | | |
|---|---|---|
| 1. Horses or ponies, any height | 13 | |
| 2 Horses or ponies, any height—handicap | 13 | |
| 3. Horses or ponies, any height—handicap | 13 | |
| | — | 39 |

## 3. SHEEP.

BLACKFACED

| | | |
|---|---|---|
| 81. Tups above one shear | 15 | |
| 82. Shearling tups | 29 | |
| 83. Ewes above one shear, with lambs | 7 | |
| 84 Shearling ewes or gimmers | 11 | |
| | — | 62 |

CHEVIOT

| | | |
|---|---|---|
| 85 Tups above one shear | 12 | |
| 86. Shearling tups | 21 | |
| 87. Ewes above one shear, with lambs | 12 | |
| 88. Shearling ewes or gimmers | 20 | |
| | — | 65 |

### BORDER LEICESTER.

| | | |
|---|---|---|
| 89. Tups above one shear | 5 | |
| 90. Shearling tups | 32 | |
| 91. Ewes above one shear | 11 | |
| 92. Shearling ewes or gimmers | 22 | |
| | — | 70 |

### HALF-BRED.

| | | |
|---|---|---|
| 93. Tups above one shear | 4 | |
| 94. Shearling tups | 11 | |
| 95. Ewes above one shear | 5 | |
| 96. Shearling ewes or gimmers | 6 | |
| | — | 26 |

### SHROPSHIRE

| | | |
|---|---|---|
| 97. Tup above one shear | 5 | |
| 98. Shearling tups | 6 | |
| 99. Ewes above one shear | 5 | |
| 100. Shearling ewes or gimmers | 5 | |
| | — | 21 |

### OXFORD DOWNS.

| | | |
|---|---|---|
| 101. Shearling tups | 5 | |
| 102. Shearling ewes or gimmers | 5 | |
| | — | 10 |

### SUFFOLK.

| | | |
|---|---|---|
| 103. Shearling tup | 1 | |
| 104. Shearling ewes or gimmers | 6 | |
| 105. Three ewe lambs | 3 | |
| | — | 10 |

### FAT SHEEP.

| | | |
|---|---|---|
| 106. Three fat shearling ewes or wethers out of blackfaced ewes | 9 | |
| 107. Three fat shearling cross-bred ewes or wethers | 5 | |
| | — | 14 |

### EXTRA SECTIONS

| | | |
|---|---|---|
| 108. Fat lambs, any breed or cross | 5 | |
| | | 283 |

## 4. SWINE

| | | |
|---|---|---|
| 109. Boars, large white breed | 5 | |
| 110. Sows, large white breed | 5 | |
| Extra stock | 1 | |
| 111. Pigs not above 8 months old, large white breed | 5 | |
| 112. Boar, white breed other than large | 1 | |
| 113. Sow, white breed other than large | 1 | |
| 114. Pigs not above 8 months old, white breed other than large | 1 | |
| 115. Boars, Berkshire breed | 5 | |
| 116. Sows, Berkshire breed | 7 | |
| 117. Pigs not above 8 months old, Berkshire breed | 4 | |
| | — | 35 |

## 5. POULTRY.

| | | |
|---|---|---|
| 1-84. Poultry | | 413 |

## 6. DAIRY PRODUCE.

| | | |
|---|---|---|
| 1. Cured butter, not less than 7 lb. | 14 | |
| 2. Fresh butter, 3 1 lb rolls | 15 | |
| 3. Cheddar cheese, 56 lb. and upwards | 9 | |
| 4. Cheese, 14 lb. and under | 8 | |
| | — | 46 |

## ABSTRACT.

| | No. of Entries. |
|---|---|
| 1. Cattle . . . . . . . . . . | 348 |
| 2. Horses | 315 |
| 3. Sheep | 283 |
| 4. Swine | 35 |
| 5. Poultry | 413 |
| 6. Dairy produce | 46 |

The following table gives a comparative view of the display of cattle, horses, sheep, swine, poultry, dairy produce, and implements, of the value of the premiums offered, and of the receipts at the entrance-gates, grand stands, and for catalogues at the Shows which have been held at Perth :—

| Year. | Cattle. | Horses. | Sheep. | Wool. | Swine. | Poultry. | Dairy Produce. | Implements. | Premiums. | Receipts. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1829 . | 192 | 53 | 78 | | 13 | ... | ... | 14 | £357 | £119 |
| 1836 . | 265 | 46 | 156 | ... | 16 | .. | 6 | 17 | 479 | 225 |
| 1852 . | 313 | 135 | 250 | . | 42 | 93 | 123 | 339 | 900 | 926 |
| 1861 . | 335 | 155 | 271 | ... | 52 | 120 | 91 | 850 | 1500 | 1328 |
| 1871 . | 376 | 177 | 300 | | 43 | 225 | 88 | 1948 | 1600 | 2270 |
| 1879 . | 383 | 253 | 220 | 11 | 40 | 157 | 49 | 2207 | 2629 | 3063 |
| 1887 . | | 239 | 311 | . | 26 | 210 | 72 | 1509 | 2372 | 1841 |
| 1896 . | 292 | 258 | 204 | . | 20 | 374 | 45 | 1945 | 2205 | 4788 |
| 1904 . | 348 | 315 | 283 | | 35 | 413 | 46 | 1972 | 3058 | 4993 |

### *A Comparison.*

The following figures, relating to some of the most successful Shows the Society has held, will be perused with interest :—

| | Cattle | Horses | Sheep. | Swine. | Poultry. | Total Live Stock | Implements | Premiums. | Drawings at Show | Profit. |
|---|---|---|---|---|---|---|---|---|---|---|
| Edinburgh, 1869 | 310 | 212 | 340 | 22 | 239 | 1123 | 1900 | £1600 | £4,078 | £2067 |
| Glasgow, 1875 . | 411 | 405 | 296 | 48 | 479 | 1639 | 2220 | 2665 | 6,231 | 3316 |
| Edinburgh, 1877 | 339 | 342 | 305 | 30 | 234 | 1250 | 2292 | 2714 | 6,734 | 3710 |
| Edinburgh, 1884 | 580 | 453 | 493 | 35 | 253 | 1814 | 2282 | 4343 | 6,548 | 1855 |
| Edinburgh, 1893 | 380 | 349 | 294 | 31 | 360 | 1414 | 2268 | 2600 | 4,918 | 2323 |
| Aberdeen, 1894 . | 314 | 321 | 184 | 34 | 365 | 1221 | 2532 | 2440 | 5,121 | 1678 |
| Perth, 1896 . | 292 | 258 | 201 | 20 | 374 | 1148 | 1945 | 2205 | 4,788 | 2511 |
| Glasgow, 1897 . | 317 | 350 | 245 | 30 | 275 | 1217 | 2227 | 2897 | 4,392 | 2021 |
| Edinburgh, 1899 | 386 | 518 | 477 | 46 | 551 | 1978 | 2585 | 3844 | 10,285 | 3911 |
| Stirling, 1900 . | 321 | 288 | 369 | 28 | 457 | 1463 | 2095 | 2915 | 4,305 | 1078 |
| Inverness, 1901 . | 360 | 257 | 204 | 22 | 499 | 1340 | 1460 | 2806 | 2,485 | 99 |
| Aberdeen, 1902 . | 330 | 253 | 243 | 42 | 475 | 1343 | 1988 | 2796 | 4,413 | 1604 |
| Perth, 1904 . | 348 | 315 | 283 | 35 | 413 | 1394 | 1972 | 3058 | 4,993 | 1828 |

## *Cattle.*

The display of cattle was of a very high character—superior to the average of recent years. The classes of Shorthorns were most creditably filled. An interesting feature in this section was the remarkable success of the animals exhibited by his Majesty the King from the Royal Farms at Windsor. A bull, a cow, and a yearling heifer were entered by his Majesty, and each headed its class; while the bull "Ronald" 79,775 (fig. 58), also won the champion prizes for the best male and the best animal of the breed. This very handsome bull was bred by her late Majesty Queen Victoria, got by "Prince Victor" 73,320, and out of "Rose of Westmoreland 2nd." The special prize of £25 for the best female Shorthorn, given by the Shorthorn Society, went to Mr H. S. Leon, Bletchley Park, for his excellent two-year-old heifer "Roseleaf," bred by himself, and got by "Silver Mint" 79,968.

The muster of Aberdeen-Angus cattle was one of the best features of the Show. Not often has this or any other breed of cattle made a better appearance in any Showyard. The classes of bulls were particularly strong in average merit. The champion animal of the breed was "Pundit of Preston" 17,156 (fig. 59), a thick well-fleshed bull, owned by Messrs Perkins & Partners, Birtley, Co. Durham, and bred by the Rev. C Bolden, got by "Rhombus of Glamis" 13,901, and out of "Pride of Preston 12th" 23,820. The classes of cows and heifers contained a large number of choice representatives of the breed.

The classes of Galloway cattle were not large, yet the breed was worthily represented in regard to merit. The Champion Medal for the best animal of this breed went to the late Sir Robert Jardine for "Alice III. of Castlemilk" 16,867 (fig. 60), a deep, thick, well-fleshed three-year-old cow of his own breeding, got by "The Pathfinder 3rd" 5991, and out of "Alice of Castlemilk" 14,282.

As has usually been the case at Perth, there was a large and excellent muster of Highland cattle. The late Earl of Southesk had a worthy champion here in "King Alaric" 1712 (fig. 61), a big handsome three-year-old bull, bred by himself, got by "Calum Riabhach II. of Atholl" 1325, and out of "Rosa Buidhe" 4253.

Although the classes of Ayrshire cattle were not large, there was no falling off in the standard of merit. The Champion Medal was won by Dr Charles Douglas, M.P., Auchlochan, Lesmahagow, with "Ardyne Pride" (fig. 62), a well-shaped cow of excellent quality, bred by Messrs R. & J. M'Alister, Mid-Ascog, Rothesay, and got by "Prince of Avondale" 3247. The special prize for the best Ayrshire bull went to Mr James

Howie, Hillhouse, Kilmarnock, for "Howie's Erin-go-braw" 5346, a very handsome bull, bred by Messrs Lindsay, Carsegown, Wigtown, and got by "Duke of Wellington" 4735.

Fat cattle made a fairly good display. The Champion Medal was awarded to Mr W. Stewart Menzies of Arndilly for "Constance of Arndilly" (fig. 63), a very well-shaped, well-fleshed heifer, which won high honours in the Fat Stock Shows of 1904.

*Horses.*

The classes of Clydesdale horses were quite up to the high standard of recent years, alike as to numbers and merit. The competition in the Stallion classes was very keen. The President's Champion Medal for the best Clydesdale stallion or colt was won by Mr Matthew Marshall, Stranraer, with his grand horse "Marcellus" 11,110 (fig. 64), bred by himself, got by "Hiawatha" 10,067, and out of "Mary Sunshine" 13,953.

In a good show of Draught geldings, Mr W. Clark, Netherlea, won the Champion Medal with "Protection" (fig. 65), a well-built two-year-old brown, bred by Mrs Gillies, Quogac, Rothesay, and got by "Macca" 11,108.

There was no lack of merit in the classes of Clydesdale mares and fillies. Mr James Boyd had a meritorious champion here in his valuable mare "Lady Margaret" 13,833 (fig. 66), bred by Mr W. Taylor, Park Mains, Renfrew, got by "Sir Everard" 5353, and out of "Maggie Taylor" by "St Lawrence."

A few very good animals appeared in the Hunter classes—the Champion Medal going to Mr John Scott, Milkvale, Lockerbie, for a stylish two-year-old chestnut gelding (fig. 67), bred by Mr Sanders, Cullyhill, Longtown, and got by "Dan Dancer."

Hackneys were few in number, but showed satisfactory merit. Sir Robert Moncreiffe, Bart., won the Champion Medal with his stylish three-year-old stallion "Moncreiffe Vengeance" 8249 (fig. 68), bred by himself, got by "Rosader" 4964, and out of "Venture" 4833.

In the Pony classes a few choice animals were shown. The Champion Medal here went to Mr T. Smith, Shirley Stud, Hall Green, Birmingham, with his handsome stallion "Pinderfield's Horace" 7952 (fig. 69), bred by Mr T. P. Robinson, got by "Sir Horace" 5402, and out of "Lady Poma" 2955.

The new classes for Polo and Riding ponies drew out a number of useful ponies. Most interesting amongst these was the Marquis of Tullibardine's stylish Arab stallion "Mahmud" (fig. 70), which won the Champion Medal in these classes.

The classes for Highland ponies continue to excite a good deal of interest. The display on this occasion was highly

creditable. The Duke of Atholl won the Champion Medal for his typical pony stallion "Bonnie Laddie" (fig. 71), bred by his Grace, got by "Herd Laddie," and out of "Minette" by "Glengarry 2nd."

Shetland ponies, as usual, made a most attractive display. The President's Medal for the best Shetland pony went to Mr Walter Aitchison, Coniecleuch, Huntly, for his beautiful mare "Strawberry" (fig. 73), bred by the Marquis of Londonderry, and got by "Odin" 32.

There was a very good turn-out in the Driving classes. The Champion Medal here went to Mr John Nairn, Forth Park, Kirkcaldy, for his characteristic gelding "Lord Dazzler" (fig. 72), a beautiful pony of unknown breeding.

*Sheep, Swine, &c.*

The Scotch breeds of Sheep were all exceedingly well represented; while some excellent Shropshire, Oxford Down, and Suffolk sheep were shown. The winners of the Champion Medals for sheep are portrayed in figs. 74, 75, 76, 77, 78, 79, and 80.

In a capital show of Swine, the Champion Medal went to "Colston Lass" 11,216, the handsome Large White sow which won the same honour for Mr R. M. Knowles at Dumfries in 1903 (fig. 73 in 'Transactions' for 1904).

The classes of Dairy Produce and Poultry were creditably filled.

# TRIALS OF AGRICULTURAL MOTORS AND DUNG-DISTRIBUTORS.

In the Highland Show held at Perth in July 1896 a novel feature was the exhibition of the first road motor seen in Scotland. In the Highland Show in the same place in July 1904 an equally notable feature was the first showyard appearance in Scotland of motors designed for field work. Whether the next eight years will see as marked a development in the manufacture and use of agricultural motors as the past eight years have witnessed in the manufacture and use of road motors, is as yet but a matter for speculation. Be that as it may, there would seem to be little room for doubt that motors both for field and road have "come to stay."

The Society's invitation to makers of agricultural motors to enter these machines for trial in connection with the Perth Show last July brought forth two exhibitors, each with one motor.

The motors were exhibited in the Show in July, and underwent practical field trials in September. In the showyard the motors were exhibited hauling reaping-machines and waggons, and their appearance excited much interest and favourable comment amongst visitors. It may indeed be said that the ease with which the motors were worked and manœuvred in the parade ring tended to remove any unfavourable impression that may have existed in the minds of those who have been reluctant to contemplate the introduction of mechanical haulage, other than at present in vogue, for field work. In these days of keen competition it is more than ever necessary that work of all kinds should be executed as quickly and as cheaply as possible, and in the agricultural motor, even in its present stage, there appears to be a machine which will assist towards the desired end. In addition to the ordinary farming operations on the land, the motor is also available for driving stationary machinery, a feature which renders it doubly valuable, especially to the farmer who cannot afford to keep an engine entirely for the latter class of work.

It was originally intended that the motors should be tried in the hay-field during the Show week; but on account of the fact that most of the hay crops in the district were already cut, this part of the trial had to be abandoned. While this was no doubt disappointing to many people, yet few doubted the capability of the motors doing this work, and rather looked for the reaping and ploughing to afford the crucial tests.

It was felt that as the agricultural motor is only just emerging from the experimental stage, the trials should not exactly be of a competitive nature, but rather more of a demonstration

to indicate the kind of work the motors were capable of doing. Inventive genius is busy at work, and no doubt in a short time great developments will be seen in the agricultural motor.

The practical trials of the motors in the cutting of corn and ploughing of land took place at Mr W. S. Ferguson's farm of Pictstonhill, near Perth, on September 15, 1904, in the presence of a fairly large company of deeply interested agriculturists.

The Committee in charge of the trials were—Mr Jonathan Middleton, *Convener*, Sir Alex. M. Mackenzie, Mr W. S. Ferguson, Mr John M'Hutchen Dobbie, Mr John Speir, Mr R. Shirra Gibb, Mr W. T. Malcolm, Mr Christie, Mr Ballingall, Mr Dun, and Professor Stanfield, *Engineer.*

The following particulars as to the two motors were supplied by the exhibitors:—

| | | |
|---|---|---|
| Name and address of exhibitor . | The Ivel Agricultural Motors, Limited, 45 Great Marlborough St., London, W. | John Scott, 14 N. St Andrew St., Edinburgh. |
| Price . . . . | With two speeds, £350; with one speed, £300. | £200. |
| Brake horse-power of motor (declared) . . . . | 18. | 14. |
| Number of cylinders . . . | Two (horizontal). | Four (vertical). |
| Diameter of cylinders, inches . | 6·0. | 3·46. |
| Stroke, inches . . . . | 5·0. | 4·33. |
| Speed of engine, revolutions per minute . . . . | 800. | 900. |
| Speed of motor, miles per hour . | 3½ (ploughing). | 2½ to 6. |
| Fuel used . . . . . | Petrol. | Petrol. |
| Cost of fuel per gallon . . | 1s. 1d. | 1s. |
| Total weight of motor, cwt. . | 30. | 26. |
| Width of motor, over all . . | 5 feet 6 inches. | 4 feet. |
| Number and width of traction-wheels . . . . | Two, 9 inches. | One, 17 inches. |
| Number and width of steering-wheels . . . . . | One, 9 inches. | Two, 4 inches. |
| Load capable of being hauled . | 4 tons 5 cwt. on level; 3 tons 14 cwt. up gradient rising 1 in 12. | 5 tons (gross) on level, 2 tons up gradient rising 1 in 10. |
| Speed of motor when hauling above load on level . . | 3½ miles per hour. | 4 miles per hour. |

Both motors are adapted for hauling all kinds of implements either on the field or road, and for driving stationary machinery such as threshing-machines and chaff-cutters. The main principle in each motor is practically the same—a high-speed petrol-engine is attached to a steel frame and connected by suitable speed-reduction gearing to the traction wheel or wheels.

## Description of Motors.

### *The Ivel Motor.*

In the "Ivel" motor (fig. 81) the two horizontal cylinders are placed on opposite sides of the crank-shaft, which is parallel to

the main driving-axle. There is an intermediate shaft, and the power is transmitted from the crank-shaft to the driving-axle through the ordinary chain-gearing and friction-clutch. One or two speeds and a reverse are fitted, and the speed of the motor can easily be regulated by the driver. The main driving-axle, which is at the rear, is made in halves and fitted with the usual differential compensating gear. Two band brakes, operated by the driver's foot, are attached to the hubs of the driving-wheels. There is one steering-wheel at the front, worked through suitable gearing from a hand wheel at the rear of the motor; the width of the steering-wheel is 9 inches, and on the top of it is fitted a metal rim 3 inches wide, to which is fixed a solid rubber tyre. This device enables the wheel to obtain a good grip on the land when turning, and it assists in reducing the vibration when the motor is driven on the road.

Fig. 81.—*The Ivel Agricultural Motor.*

The engine works on the ordinary four-cycle principle, the inlet valves open automatically at each suction stroke, and the exhaust valves are operated by a cam on a shaft rotating at half

the speed of the engine-shaft. The petrol, after being vaporised in a carburettor and mixed with the proper proportion of air, is drawn into the cylinders, and at the end of the compression stroke is exploded by means of an electric spark, which, at the proper moment, passes between the terminals of a sparking plug. The sparking can be retarded or advanced at will by the driver through a timing lever, and a change of speed brought about. The products of combustion pass through a pipe to the silencer or exhaust-box, which is placed immediately below the framing of the engine. The speed of the engine is controlled by means of a sensitive centrifugal governor, which acts by altering the tension of a spring coupled to the throttle-valve lever. There are two friction-clutches fitted to the engine-shaft—one for the forward motion and the other for the reverse. When starting the engine both of these clutches are disengaged, but can be put into gear by the driver moving the main starting lever.

For driving stationary machinery, a belt is placed on a pulley keyed to one end of the engine-shaft, which projects beyond the casing of the motor. When slow driving for heavy machinery is required, this pulley is placed on the end of the intermediate shaft: in this case the motor must be jacked up and the near-side road-wheel removed to give the necessary clearance for the pulley. The electric current for igniting the charge is obtained from an accumulator.

*The Scott Motor.*

There are four vertical cylinders in the "Scott" motor (fig. 82), and the crank-shaft, which is at right angles to the main driving-axle, is connected to an intermediate shaft through a friction-clutch and system of bevel gearing: the main axle is driven from this intermediate shaft by the ordinary chain-gearing. In the motor exhibited there was only one traction-wheel placed at the rear. The steering-wheels have their bearings mounted at the ends of vertical bars connected by suitable levers to the steering-handle. One of these vertical bars is provided with a screw adjustment by means of which the height of its wheel may be varied, as, for instance, when ploughing one wheel runs in the furrow while the other is on the unploughed surface, and the motor may thus be kept in a level position transversely. The mechanism in the "Scott" motor is of a very simple description, and should not readily get out of order.

In this motor a mowing-machine or a harvester may be attached to the front as well as to the back, the front machine being driven by gearing from the main engine-shaft. When ploughing, a contrivance is provided by which it is not necessary to have a second man to control the plough, which is manipu-

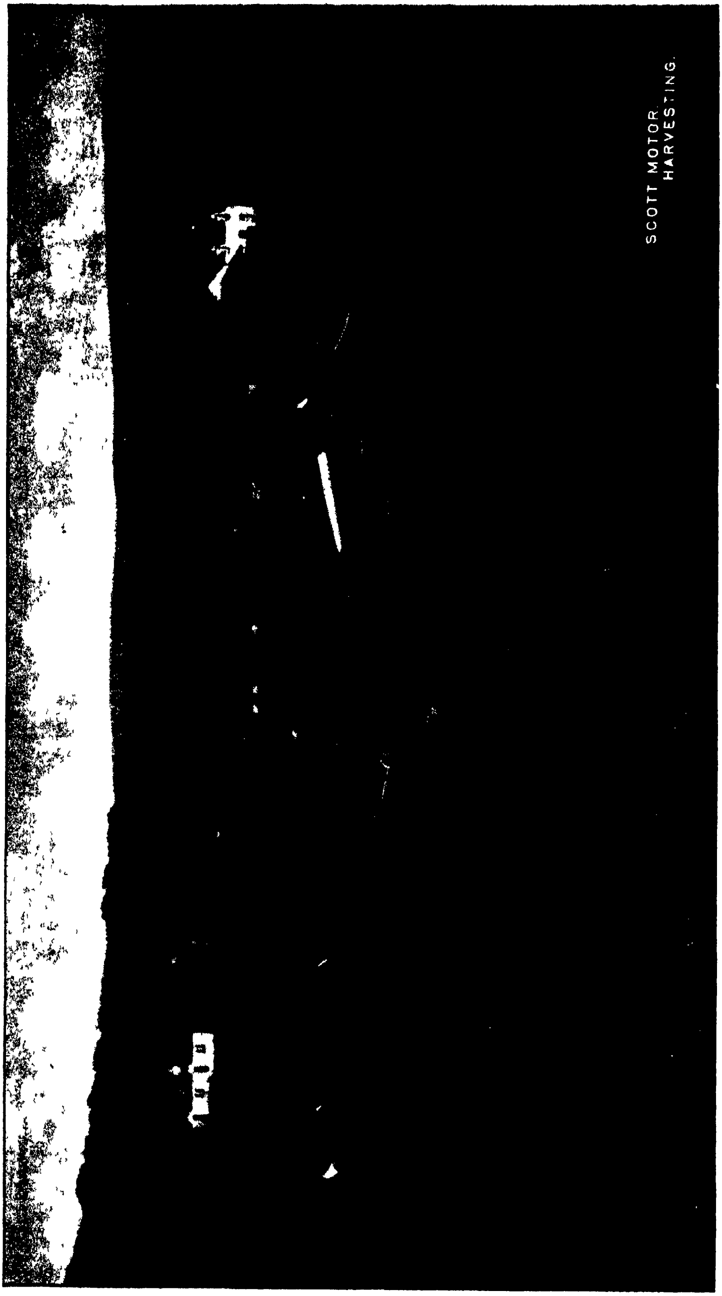



Fig 82.—*The Scott Agricultural Motor.*

lated by the motor-man. The "Scott" motor can be used for all kinds of farming operations, and a special feature is made of its adaptation for working a cultivator. A brake and the usual reversing gear are provided.

The gauge of the steering-wheels is also adjustable. When working in soft ground grabs can be fitted to the traction-wheel.

### Report on the Trials.

The first part of the trial consisted in the cutting of a portion of a field of oats. The crop was of medium weight, the greater part standing up regularly, thus enabling the cutting to be done continuously round two plots which had been measured and set apart for the trials.

The "Ivel" motor, to which was attached an "Albion" No. 3 5-feet-cut reaper and binder, made by Messrs Harrison, M'Gregor, & Co., Ltd., Leigh, Lancashire, was set to cut a plot measuring 2·73 acres. This task it accomplished in 1 hour 54 minutes, using 2·02 gallons of petrol, or at the rate of one acre in 41¾ minutes, with an expenditure of 0·74 gallons of petrol per acre, practically costing 9½ pence, not including the wages of the men and the interest on the cost of motor and depreciation.

The "Ivel" motor, which was under the superintendence of the inventor, Mr Dan Albone, worked satisfactorily, and the engines did not stop once during the trial; the motor was required to stop on several occasions for a few seconds on account of objects interfering with the working of the binder. In the opinion of those competent to judge, it was considered that this motor was run at too great a speed, and doubts were expressed as to the ability of the reaping-machine to stand the excessive strain for any length of time. If in the future it is found necessary to adopt such high speeds, the makers of reaping-machines will require to construct them on stronger and different lines.

The "Scott" motor was provided with a "Hornsby" 5-feet-cut reaper and binder, and was allotted a plot of corn 2·835 acres in extent. The motor made several circuits of the plot in a creditable manner, doing its work not so quickly as its rival, but in a very neat manner. Unfortunately, at this stage part of the mechanism failed to act properly, and the motor was unable to complete its task. The stoppage was due to a friction-clutch failing to grip. It is much to be regretted that a defect of so insignificant a character should have been the means of putting this motor out of action for the time being. Amongst those present, the "Scott" motor created a favourable impression.

The "Ivel" motor was also tried on a portion of the field in

which the crop was slightly heavier than the rest, while some bits were laid, thus necessitating the machine to cut one way and return empty. This part of the work the "Ivel" carried out satisfactorily, the high rate of speed, about six miles per hour, at which the motor travelled over the ground when not cutting being especially noticeable.

Later in the day both motors were tried at the plough. The "Ivel" drew a three-furrow plough made specially for the motor by Messrs J. & F. Howard. This plough can be altered if required into a two-furrow implement without using a spanner. The "Ivel" seemed to experience no difficulty in executing the task allotted to it, the depth of the furrows varying from 6 inches to 8 inches. The "Scott" motor, to which was attached a Massey-Harris two-furrow plough, had again to encounter bad luck, and was compelled to stop on several occasions.

## General Notes.

The land was especially favourable to the motors, and it is desirable that trials should be made on wet ground, as it is possible that skidding may be set up, though the application of grabs to the wheels would tend to prevent this evil. No injurious effect of the wheels on the ground was particularly noticeable, though if the weather had been wet this might have been serious. It is difficult to form an opinion as to which system is least harmful—one wide or two narrower traction-wheels. The collective width of the two traction-wheels in the "Ivel" motor is slightly in excess of the width of the single wheel in the "Scott" motor, but the weight of the former is somewhat greater than that of the latter, so that in this respect the motors are practically equal.

The "Scott" motor appears simpler in design than the "Ivel," but there is always a possibility of sacrificing efficiency to simplicity. It is to be regretted that the "Scott" motor was not able to complete its work, and thus have afforded a better opportunity of comparing it with the rival machine. The negotiation of the corners of the plots during the reaping seemed to offer a certain amount of difficulty, but probably this may not be considered a very serious defect.

The motors were under perfect control, and considerable admiration was expressed at the ease with which they stopped and started during the cutting. In fact, in this respect they seemed superior to horses.

The adaptability of the motor to so many operations pertaining to farming renders it a most useful and valuable source of power. The quickness with which the work is done is especially noticeable. Beyond the interest on outlay and de-

preciation, the agricultural motor does not cost anything until it is put into motion.

It is somewhat difficult to arrive at any definite figures as to the cost of mowing, reaping, or ploughing, as the character and nature of the crops and land vary so much, and will affect the results. The exhibitors of the two motors have supplied the following data as to the total cost per acre and the time required for performing the work:—

| | Total cost per acre. | Time required per acre. |
|---|---|---|
| Mowing . . | 6d. to 1s. 9d. | 15 to 30 minutes. |
| Reaping . . | 1s. " 1s. 9d. | 30 " |
| Ploughing . . | 4s. " 5s. | $1\frac{1}{2}$ to 2 hours. |
| Cultivating . . | 1s. 6d. " 4s. | $\frac{3}{4}$ to $1\frac{1}{4}$ " |

If the above figures are reasonably correct, it would appear that the cost of motor traction works out at a very cheap rate.

Taking the trials as a whole, they were in every way a success, and in recognition of the substantial progress which the makers had made in bringing out a thoroughly useful agricultural motor, the Committee awarded one of the Highland and Agricultural Society's gold medals to each of the two exhibitors.

## DUNG- AND MANURE-SPREADERS.

While the agricultural motors were engaged in ploughing, a demonstration with manure-spreaders was taking place in another part of the field.

Messrs J. D. Allan & Son, Culthill Works, Murthly, exhibited their new machine for distributing farmyard manure in drills only (fig. 83). The spreader is attached to any form of farm cart, and has two road-wheels, one going on the top of the drill, the other in the furrow. It can be regulated to any width of drills, and it is so designed that it can put down the manure in any desired thickness. The man in charge of the cart forks the manure into the hopper of the machine, and taking one drill at a time, the process of spreading is accomplished in one operation.

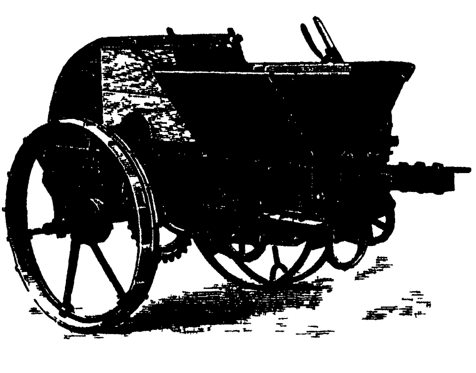


Fig. 83.—*Allan's Drill Dung-Spreader.*

At the bottom of the hopper there is an endless travelling

web or band for conveying the manure to a revolving spiked drum, which breaks up the manure and throws it against a grating fixed above the drum. The small particles pass through the grating, while the lumps fall back to be further broken up.

The machine worked in a very successful manner, and those present expressed themselves as being exceedingly well pleased at the efficiency and thoroughness with which the work was performed.

The Committee resolved to recommend that the Society's silver medal be awarded to Messrs Allan & Son for this machine, and this recommendation has been confirmed by the Directors.

Another machine on the ground was the "Worcester Kemp" manure-spreader (fig. 84) brought forward by Messrs John Wallace & Sons, Glasgow, who are the agents for the Richardson Manu-

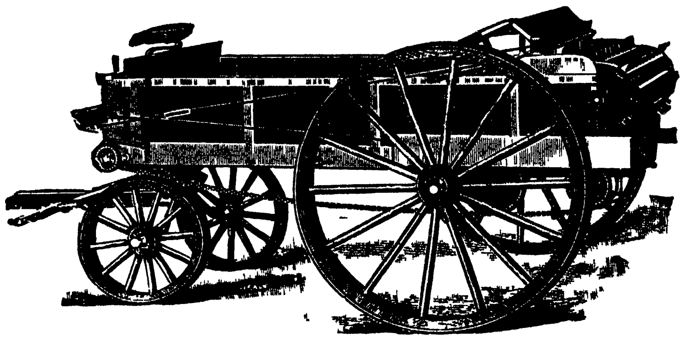


Fig 84.—*The Kemp Dung and Manure-Distributor.*

facturing Co. of Worcester, Mass., the makers of this machine. As will be seen from the following illustration, the "Worcester Kemp" spreader takes the form of a long waggon on four wheels. The floor of the waggon consists of a travelling apron driven by two chains, one on either side. The head-board is fastened to the front end of this apron, and the entire bottom is rolled back by means of the two chains, so as to draw the manure on to a revolving drum or beater which breaks up the manure and distributes it broadcast or in drills as desired. The amount of feed can easily be regulated by a lever at the driver's seat, so as to spread from five to forty loads to the acre.

This machine is very simple in construction, and appeared to do its work well with any kind of manure. The opinion was formed that both these manure-spreaders should prove important labour-savers in this country.

JONATHAN MIDDLETON, *Convener of Committee.*
R. STANFIELD, *Engineer.*

## TRIAL OF DUNG-SPREADERS.

An Exhibition Trial of Machines for spreading Farmyard Dung was held by the Society on the 12th January 1905 on a very suitable field, kindly granted by Mr R. S. Gray, Southfield, Portobello. The weather was favourable, but the attendance of farmers was small.

The following particulars were supplied in connection with the three machines submitted for trial:—

| | | | |
|---|---|---|---|
| Exhibitor . | Messrs J. & D. Allan & Sons, Murthly. | Messrs A. & J. Main, Edinburgh. | Messrs J. & W. Wallace, Glasgow. |
| Maker . | " | The American Harrow Co., Detroit, Mich., U.S.A. | The Richardson Manufacturing Co., Worcester, Mass., U.S.A. |
| Name of Machine. | — | "New American" Manure Spreader. | "Worcester-Kemp" Manure Spreader. |
| Type. . | Drill Spreader. | Broadcast Spreader. | Broadcast Spreader. |
| Price. . | £15. | £40. | £35. |

Messrs Allan's machine and the "Worcester-Kemp" spreader are fully described in the report on the trials at Pictstonhill on page 427 of this volume.

The "New American," like the "Worcester-Kemp," is of the travelling-bottom, four-wheel waggon type of machine, but it differs from the latter in this respect, that the bottom returns automatically when the load of manure has been discharged.

In the "New American" machine the toothed distributing cylinder is driven by sprocket and chain-gearing from a large sprocket wheel on the rear axle—three sizes of sprocket wheels are fitted to the cylinder shaft for giving different speeds to it. The motion of the travelling bottom is obtained through a system of links worked from a crank on the end of the distributing cylinder shaft, the links operate pawls gearing with ratchet wheels secured to the end of the feed-shaft, the rotation of which determines the rate of movement of the travelling bottom. As soon as the load has been discharged, a trip mechanism reverses the above pawls, so that they cause the feed-shaft to revolve in the opposite direction, and thus the bottom is returned to its original position, ready to receive another load; the return of the bottom can be effected at a much quicker rate than the forward speed.

The volume of the manure discharged is determined by the speed of the travelling bottom, and this can be regulated by the

driver through a lever at his side while the machine is in actual operation.

The bottom is made of a considerable number of separate narrow boards or laths fastened to a one-way-hinge coupling or link, which turns only one way, so that when the bottom is straight it becomes a practically solid platform supported on a suitable roller-bed.

*Results of the Trials.*

The trials on the whole were considered satisfactory. Messrs Allan's drill spreader did its work very well; it is simple of construction, light, and easy to manipulate. The distribution of the manure is very even, and the feed can be adjusted so as to deposit a large or a small quantity in the drills as desired. This machine appeared to create a very favourable impression amongst those who saw it working.

The "New American" and "Worcester-Kemp" machines have a considerable length of body, and are capable of carrying a large quantity of manure; the former, the larger, was worked by three horses, and the latter by two.

There is no doubt that these machines can spread the manure very well indeed, and at a rapid rate, while the distribution over the ground is uniform. The manure is well broken up, and the rate of discharge—heavy or light—seemed to be under perfect control.

No hitch of any kind occurred to any of the machines during the trials, which were carried out under ordinary conditions as to character of land and manure.

In view of the scarcity of manual labour, it would seem probable that these mechanical helps to farm work may have an extensive use in this country in the near future.

JONATHAN MIDDLETON, *Convener of Committee.*
R. STANFIELD, *Engineer.*

# PREMIUMS AWARDED BY THE SOCIETY IN 1904.

## I.—PERTH SHOW

*19th, 20th, 21st, and 22nd July 1904.*

ABBREVIATIONS.—V., *Very Highly Commended.* H., *Highly Commended.* C., *Commended.*

### CATTLE

#### SHORTHORN.

*PRESIDENT'S CHAMPION MEDAL for best Shorthorn.*

His Majesty the King, The Royal Farms, Windsor, "Ronald" (79,775).

*Best Shorthorn Bull in the Show*—£25, given by the Shorthorn Society.

His Majesty the King, The Royal Farms, Windsor, "Ronald" (79,775).

*Breeder of best Bull of any age in Classes* 1, 2, *and* 3—The Silver Medal.

Her Late Majesty Queen Victoria.

**CLASS 1. BULL, calved before 1902.—Premiums, £15, £10, £5, and £3.**

1. His Majesty the King, The Royal Farms, Windsor, "Ronald" (79,775).
2. Robert Taylor, Carlogie House, Carnoustie, "March On" (97,357).
3. T. Atkinson, Redvales Farm, Bury, Lancashire, "Chewton Victor 6th" (80,686).
4. Captain C. Home Graham-Stirling of Strowan, Crieff, "Strowan Champion."
V. Lumsden & Mackenzie, Huntingtowerfield, Perth, "Golden Star" (76,799).
H. Robert Bruce, Heatherwick, Inverurie, "First Fiddle" (83,480).

**CLASS 2. BULL, calved in 1902.—Premiums, £15, £10, £5, and £3.**

1. Matthew Marshall, Bridgebank, Stranraer, "Roan Conqueror."
2. Robert Taylor, Pitlivie Farm, Carnoustie, "Vice-Consul" (84,970).
3. Laurence Johnston of Sands, Kincardine-on-Forth, "Meridian."
4. George Harrison, Gainford Hall, Darlington, "Duke of Lorn."
V. George Smith Grant, Minmore, Glenlivet, "Lavender Chief."
H. Duncan Stewart, Millhills, Crieff, "Proud Favourite" (84,420).
H. A. Cameron & Sons, Westside Farm, Brechin, "Bannockburn Secret" (82,765).
C. Sir John Gilmour of Lundin and Montrave, Bart., Leven, "Champion."

**CLASS 3. BULL, calved in 1903.—Premiums, £12, £8, £4, and £2.**

1. Duncan Stewart, Millhills, Crieff, "Royal Eclipse."
2. Alexander T. Gordon, Combscauseway, Insch, N.B., "Sterling Coin."
3. Robert Taylor, Pitlivie Farm, Carnoustie, "Pitlivie General."
4. Robert Taylor, Pitlivie Farm, Carnoustie, "Hamlet 2nd."

V. George Harrison, Gainford Hall, Darlington, "Fairy King of Gainford."
H. Herbert Samuel Leon, Bletchley Park, Bletchley, Bucks, "Challenger."
C. J. Douglas Fletcher of Rosehaugh, Avoch, N.B., "Shy Prince."
C. William T. Malcolm, Dunmore, by Larbert, "Collynie Prince."
C. Captain A. Stirling of Keir, Dunblane, "Keir Jester."

*Best Shorthorn Female in the Show*—£25, given by the Shorthorn Society.

Herbert Samuel Leon, Bletchley Park, Bletchley, Bucks, "Roseleaf."

CLASS 4. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. His Majesty the King, The Royal Farms, Windsor, Berks, "Sylph."
2. Captain C. Home Graham-Stirling of Strowan, Crieff, "Mavis Clair."
3. Alexander T. Gordon, Combscauseway, Insch, N.B., "Lady Mary 4th."
4. A. W. & A. M. Law, Mains of Sanquhar, Forres, "Ruth 3rd."
V. A. G. Maxtone Graham, Redgorton, Perth, "Bride of Lincoln."
H. James M'William, Stoneytown, Keith, "Radiance."
C. Robert Taylor, Pitlivie Farm, Carnoustie, "Merry Girl 6th."

CLASS 5. HEIFER, calved in 1902.—Premiums, £10, £5, £3, and £2.

1. Herbert Samuel Leon, Bletchley Park, Bletchley, Bucks, "Roseleaf."
2. The Duke of Richmond and Gordon, Gordon Castle, Fochabers, "Duchess 44th."
3. Robert Taylor, Pitlivie Farm, Carnoustie, "Duchess of Pitlivie 2nd."
4. T. J. Sowerby, Long Meg, Langwathby, R.S.O., Carlisle, "Sea Gem."
V. The Duke of Richmond and Gordon, Gordon Castle, Fochabers, "Duchess 19B."
H. James M'William, Stoneytown, Keith, "Lady Rose."
C. George Harrison, Gainford Hall, Darlington, "Ascott Lassie."

CLASS 6. HEIFER, calved in 1903.—Premiums, £10, £5, £3, and £2.

1. His Majesty the King, The Royal Farms, Windsor, "Madeleine."
2. George Harrison, Gainford Hall, Darlington, "Montrave Winsome."
3. Robert Taylor, Pitlivie Farm, Carnoustie, "Pitlivie Carnation."
4. James M'William, Stoneytown, Keith, "Hilda 2nd."
V. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Dalmeny Strawberry 2nd."
H. A. W. & A. M. Law, Mains of Sanquhar, Forres, "Queenie Grace 5th."
C. Robert Taylor, Pitlivie Farm, Carnoustie, "Pitlivie Pearl."
C. William T. Malcolm, Dunmore, by Larbert, "Lady Kathleen."

## ABERDEEN-ANGUS.

*PRESIDENT'S CHAMPION MEDAL for best Aberdeen-Angus Animal.*

Charles Perkins & Partners, Birtley, County Durham, "Pundit of Preston" (17,156).

*Best Bull of any age in Classes* 7, 8, *and* 9—Ballindalloch Challenge Cup value £50, given by Sir George Macpherson Grant, Bart.

Charles Perkins & Partners, Birtley, County Durham, "Pundit of Preston" (17,156).

*Breeder of best Bull of any age in Classes* 7, 8, *and* 9—The Silver Medal.

Rev. Charles Bolden, Preston Bissett, Buckingham.

*Best Breeding Animal of the Breed in the Showyard*—Champion Gold Medal, given by the Polled Cattle Society.

Charles Perkins & Partners, Birtley, County Durham, "Pundit of Preston" (17,156).

*Breeder of the Winner of the Ballindalloch Challenge Cup*—Silver Medal.

Rev. Charles Bolden, Preston Bissett, Buckingham.

CLASS 7. BULL, calved before 1st December 1901.—
Premiums, £15, £10, £5, and £3.

1. Charles Perkins & Partners, Birtley, County Durham, "Pundit of Preston" (17,156).
2. George T. Cran, Morlich, Glenkindie, Aberdeen, "Jeshurun" (19,257).
3. A. T. Reid, Auchterarder House, Auchterarder, "Proud Forrester" (19,745).
4. His Majesty the King, Abergeldie Mains, Ballater, "Elandslaagte" (17,745).
V. Sir Donald Currie, G.C.M.G., Glenlyon Home Farm, Fortingall, "Lord Fearless" (18,086).
H. C. L. Wood, Freeland, Forgandenny, Perth, "Emil" (19,051).
C. W. S. Ferguson, Kinochtry, Coupar-Angus, "Ballo" (18,755).

CLASS 8. BULL, calved on or after 1st December 1901.—
Premiums, £15, £10, £5, and £3.

1. R. W. Hudson, Danesfield, Marlow, Buckinghamshire, "Knight of Danesfield" (20,738).
2. Sir Robert Anderson, J.P., The Park, Dunmurry, County Antrim, "Jim of Delvin" (20,690).
3. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Ebbero" (20,399).
4. James Kennedy, of Doonholm, Ayr, "Evarra" (20,507).
V. William Watt, Middlefield, Cupar, "Burly Chield" (20,221).
H. George Smith Grant, Auchorachan, Glenlivet, "Prince Forest" (21,106).
C. John Macpherson, Mulben Keith, "Khartoum of Ballindalloch" (20,732).

CLASS 9. BULL, calved on or after 1st December 1902.—
Premiums, £12, £8 £4, and £2.

1. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Eblamere" (21,781).
2. Archibald Whyte, Inverquharity, Kirriemuir, "Donford" (21,744).
3. J. Ernest Kerr, Harviestoun Castle, Dollar, "Parsee of Harviestoun" (22,401).
4. C. Bolden, Preston Bissett, Buckingham, "Proprietor of Preston" (22,553).
V. Charles Calder, Woodhill, Ponteland, Newcastle-on-Tyne, "Perfection of Sands" (22,420).
H. Col. Charles M'Inroy, C.B., of The Burn, Edzell, "B.B.B." (21,559).
C. James Kennedy of Doonholm, Ayr, "Luncher of Cortachy" (22,241).

*Best Cow of any age in Class* 10—Ballindalloch Challenge Cup, value £50, given by the late Mr C. Macpherson Grant of Drumduan.

R. W. Hudson, Danesfield, Marlow, Bucks, "Effulgent of Danesfield" (28,617).

*Breeder of the Winner of the Ballindalloch Challenge Cup*—Silver Medal.

R. W. Hudson, Danesfield, Marlow, Bucks.

CLASS 10. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. R. W. Hudson, Danesfield, Marlow, Bucks, "Effulgent of Danesfield" (28,617).
2. W. B. Greenfield, Haynes Park, Bedford, "Darling of Haynes 2nd" (32,047).
3. David Arnot, Mains Edzell, Edzell, "Fanny of Edzell" (27,869).
4. William Wilson, Coynachie, Gartly, N.B., "Coynachie Ruth 3rd" (33,010).
V. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Eloquent" (30,084).
H. George Willsher, Pitpointie, Dundee, "Vegetable 4th of Knapperna" (30,918).

CLASS 11. HEIFER, calved on or after 1st December 1901.—
Premiums, £10, £5, £3, and £2.

1. Robert Wylie Hill, Balthayock, Perth, "Bartonia of Glamis" (34,693).
2. The Earl of Airlie, Cortachy Castle, Kirriemuir, "Annie of Cortachy" (33,074).
3. J. Ernest Kerr, Harviestoun Castle, Dollar, "Pride of Powrie 14th" (36,408).
4. William Wilson, Coynachie, Gartly, N.B., "Sweetheart 6th of Coynachie" (34,938).
V. W. S. Ferguson, Kinochtry, Coupar-Angus, "Fairy of Kinochtry" (33,581).
H. Alexander M'Laren, Auchnaguie, Tullymet, Ballinluig, "Primrose of Garvault" (33,940).

Vatt, Middlefield, Cupar, "Nicippe" (33,076).

CLASS 12. HEIFER, calved on or after 1st December 1902.—
Premiums, £10, £5, £3, and £2.

1. C. L. Wood, Freeland, Forgandenny, Perth, "Lustre of Freeland" (36,672).
2. Charles Edward Hunter, Selaby, Gainford, Darlington, "Ruritania" (35,794).
3. The Earl of Airlie, Cortachy Castle, Kirriemuir, "Aristoclea" (34,981).
4. T. H. Bainbridge, Eshott Hall, Felton, Northumberland, "Black Maiden."
V. C. L. Wood, Freeland, Forgandenny, Perth, "Lamella of Freeland" (36,671).
H. Alexander M'Laren, Auchnaguie, Tullymet, Ballinluig, "Harmona" (36,031).
C. Sir George Macpherson Grant, Bart., The Castle, Ballindalloch, "Beckoning Maid" (35,598).

*EXTRA STOCK.*

The following was Very Highly Commended, and a Medium Silver Medal awarded.

W. K. M'Donald, Ballintuim, Blairgowrie, Cow, "Strathardle Belle 2nd" (27,171).

GALLOWAY.

*PRESIDENT'S CHAMPION MEDAL for best Galloway.*

Sir Robert Jardine of Castlemilk, Bart., Lockerbie, "Alice III. of Castlemilk" (16,867).

*Breeder of best Bull of any age in Classes* 13, 14, *and* 15—The Silver Medal.

Robert F. Dudgeon, of Cargen, Dumfries.

CLASS 13. BULL, calved before 1st December 1901.—
Premiums, £15, £10, £5, and £3.

1. John Cunningham, Tarbreoch, Dalbeattie, "Bondsman" (7306).
2. Robert Graham, Auchengassel, Twynholm, "Defiance" (8266).
3. James Wilson, Tundergarth Mains, Lockerbie, "War Cry" (8236).

CLASS 14. BULL, calved on or after 1st December 1901.—
Premiums, £15, £10, £5, and £3.

1. James Wilson, Tundergarth Mains, Lockerbie, "Woodland Prince" (8772).
2. Robert Graham, Auchengassel, Twynholm, "Explorer" (9072).

CLASS 15. BULL, calved on or after 1st December 1902.—
Premiums, £12, £8, £4, and £2.

1. C. R. Dudgeon, Cargen, Dumfries, "Chief III." (8892).
2. Sir Robert Jardine of Castlemilk, Bart., Lockerbie, "Director of Castlemilk" (8823).
3. John Cunningham, Tarbreoch, Dalbeattie, "Chancellor of Ballyboley" (9010).
4. Thomas Graham, Marchfield, Dumfries, "Stanley of Lockenkit" (8847).
V. The Very Rev. John Gillespie, LL.D., Mouswald Manse, Ruthwell, "Certain of Stepford" (8889).

CLASS 16. COW, of any age.—Premiums, £12, £8, £4, and £2.

1. Sir Robert Jardine, Bart., of Castlemilk, Lockerbie, "Alice III. of Castlemilk" (16,867).
2. Sir Robert Jardine, Bart., of Castlemilk, "Alice II. of Castlemilk" (16,352).
3. C. R. Dudgeon, Cargen, Dumfries, "Trilby of Castlemilk" (15,902).
4. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lady Stanley 10th" (15,432).
V. John Cunningham, Tarbreoch, Dalbeattie, "Doris of Kilquharity" (16,912).
H. Sir Robert Jardine of Castlemilk, Bart., Lockerbie, "Alice of Castlemilk" (14,282).
C. Robert Graham, Auchengassel, Twynholm, "Violet 3rd of Cally" (13,787).

CLASS 17. HEIFER, calved on or after 1st December 1901.—
Premiums, £10, £5, £3, and £2.

1. Hugh Fraser, Arkland, Dalbeattie, "Lady Grace 3rd" (17,485).
2. John Cunningham, Tarbreoch, Dalbeattie, "Maggie Lauder of Tarbreoch" (17,466).
3. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lady Stanley 16th of Chapelton" (17,403).
4. H. Voigt, Lowry Hill, Carlisle, "Belle of Lowry Hill" (17,950).
V. Hugh Fraser, Arkland, Dalbeattie, "Lady Nancy 3rd" (17,482).
H. John Cunningham, Tarbreoch, Dalbeattie, "Dorrit of Castlemilk" (17,387).
C. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lizzie of Chapelton" (17,418).

CLASS 18. HEIFER, calved on or after 1st December 1902.—
Premiums, £10, £5, £3, and £2.

1. David Brown, Auldgirth, by Dumfries, "Esmee of Stepford" (17,952).
2. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Sweet Secret of Chapelton" (17,926).
3. Thomas Biggar & Sons, Chapelton, Dalbeattie, "Lady Stanley 19th of Chapelton" (17,918).
4. James Wilson, Tundergarth Mains, Lockerbie, "Harriet 7th of Tundergarth Mains" (18,124).
V. John Cunningham, Tarbreoch, Dalbeattie, "Lady Stanley of Whitecairn" (17,935).
H. David Brown, Auldgirth, Dumfries, "Lady Scott 2nd of Stepford" (17,956).
C. Sir Robert Jardine of Castlemilk, Bart., Lockerbie, "Lady Alice of Castlemilk" (17,963).

HIGHLAND.

*PRESIDENT'S CHAMPION MEDAL for best Highland Animal.*

The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "King Alaric" (1712).

*Breeder of best Bull of any age in Classes* 19, 20, *and* 21—The Silver Medal.

The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B.

CLASS 19. BULL, calved before 1902.—Premiums, £15, £10, £5, and £3.

1. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "King Alaric" (1712).
2. D. A. Stewart, Ensay, Obbe, Portree, "Morair-nan-Eilean."
3. The Duke of Sutherland, K.G., Dunrobin Castle, Sutherlandshire, Golspie, "Ben Laoghal."
4. Colonel Malcolm, C.B., of Poltalloch Lochgilphead, "Calum Buidhe II. of Atholl."
V. Sir Reginald A. E. Cathcart of Carlton, Bart., Cluny Castle, Aberdeen, "Valerius" (1753).
H. Bryce Allan, Linndhu, Tobermory, "Domhnull Mollach II. of Barguillean" (1804).
C. J. R. Moreton Macdonald of Largie, Largie Castle, Tayinloane, "An Fear Caiderach" (1767).

CLASS 20. BULL, calved in 1902.—Premiums, £15, £10, £5, and £3.

1. The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Fear-a-Bhata of Atholl."
2. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "Prince Colin" (1878).
3. Wm. Dalziel Mackenzie of Farr and Newbie, Farr House, Daviot, Inverness, "Calum Ban of Farr" (1783).
4. J. R. Moreton Macdonald of Largie, Largie Castle, Tayinloane, "Ian Riabhach-na-Laragaidh."
V. Sir Donald Currie, G.C.M.G., of Garth and Glenlyon, Aberfeldy, "Roualeyn" (1889).
H. J. R. Moreton Macdonald of Largie, Largie Castle, Tayinloane, "Rob Ban-na-Laragaidh."
C. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Victor XXV." (1900).

CLASS 21. BULL, calved in 1903.—Premiums, £12, £8, £4, and £2.

1. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Valentine XXIII."
2. Allan Gilmour Thom, Island of Canna, Oban, "Waverley."
3. The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Calum-na Airidh of Atholl."
4. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "King Malcolm."
V. Colonel Malcolm, C.B., of Poltalloch, Lochgilphead, "Am Fiuran-Maiseach."
H. James D. Graham, Airthrey Castle, Bridge of Allan, "Domhnull Riabhaich of Airthrey."
C. James D. Graham, Airthrey Castle, Bridge of Allan, "Maoldonaich of Airthrey."

CLASS 22. COW, of any age, in Milk, or with Calf at Foot.—Premiums, £12, £8, £4, and £2.

1. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Cruinneag VI. of Ardtornish" (4790).
2. The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Te Riabhach V. of Atholl" (5407).
3. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "May Queen V." (4796).
4. Colonel Malcolm, C.B., of Poltalloch, Lochgilphead, "Ealasaid Bhuidhe" (4641).
V. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Sgiathach 15th" (3809).
H. D. A. Stewart, Ensay, Obbe, Portree, "Shelley."
C. The Marquis of Breadalbane, K G., Taymouth Home Farm, Kenmore, Aberfeldy, "Proiseaig V. of Breadalbane."

CLASS 23. HEIFER, calved in 1901.—Premiums, £10, £5, £3, and £2.

1. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "Princess Morella" (5302).
2. John Stewart, Bochastle, Callander, "Ruadh Mhor II."
3. Thomas Valentine Smith of Ardtornish, Morvern, R.S O., "May Queen VIII." (5847).
4. A. D. & D. M'Gregor, Kinlochmoidart, Moidart, Fort William, "Mari III."
V. D. A. Stewart, Ensay, Obbe, Portree, "Shelley."
H. Thomas Valentine Smith of Ardtornish, Morvern, R S.O, "Sgiathach 33rd of Ardtornish" (5853).
C. A. D. & D. M'Gregor, Kinlochmoidart, Moidart, Fort William, "Fiuran."

CLASS 24. HEIFER, calved in 1902.—Premiums, £10, £5, £3, and £2.

1. D. A. Stewart, Ensay, Obbe, Portree, "Laochag."
2. The Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B., "Princess Stella" (5870).
3. The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Annag Riabhach 8th of Atholl."
4. J. S. Ainsworth, M.P., of Ardanaiseig, Kilchrenan, "Roibhinn III."
V. Thomas Valentine Smith of Ardtornish, Morvern, R.S.O., "Ban-Mhuileach XI."
H. James D. Graham, Airthrey Castle, Bridge of Allan, "Mairi Othar I. of Airthrey."
C. John Stewart, Bochastle, Callander, "Ghuanach Ruadh."

## AYRSHIRE.

*PRESIDENT'S CHAMPION MEDAL for best Ayrshire.*

Charles Douglas, M.P., Auchlochan, Lesmahagow, "Ardyne Pride" (14,056).

*Best Ayrshire Bull in the Showyard*—Champion Prize of £10, given by the Ayrshire Cattle Herd-Book Society.

James Howie, Hillhouse, Kilmarnock, "Howie's Erin-go-braw" (5346).

*Breeder of best Bull of any age in Classes 25, 26, and 27*—The Silver Medal.

Messrs Lindsay, Carsegown, Wigtown.

CLASS 25. BULL, calved before 1902.—Premiums, £12, £8, and £4.

1. Robert Osborne, Morton Mains, Thornhill, "Hochmagandie" (5141).

CLASS 26. BULL, calved in 1902.—Premiums, £10, £7, and £3.

1. James Howie, Hillhouse, Kilmarnock, "Howie's Erin-go-braw" (5346).
2. James Howie, Hillhouse, Kilmarnock, "Wynflette" (5441).
3. James M'Farlane, Oxhill, Bucklyvie, "Bold Stunner" (5278).
V. Robert Osborne, Morton Mains, Thornhill, "Morton Castle" (5440).

CLASS 27. BULL, calved in 1903.—Premiums, £8, £5, and £3.

1. James Howie, Hillhouse, Kilmarnock, "Howie's Spicey Robin" (5531).
2. Andrew Mitchell, Barcheskie, Kirkcudbright, "Crown Imperial" (5694).
3. John M'Alister, Ardyne, Toward, "Matchless."
V. Thomas Barr, Monkland, Kilmarnock, "Zomo-sal."

*Best Ayrshire Female in the Showyard*—Champion Prize of £10, given by the Ayrshire Cattle Herd-Book Society.

Charles Douglas, M.P., Auchlochan, Lesmahagow, "Ardyne Pride" (14,056).

CLASS 28. COW, calved before 1901, in Milk.—Premiums, £12, £8, and £4.

1. Colonel G. J. Fergusson-Buchanan of Auchentorlie, Bowling, "Marguerite" (17,044).
2. John M'Alister, Ardyne, Toward, "Lady Finlay."
3. Thomas C. Lindsay, Aitkenbrae, Monkton, "Nellie Sloth 1st of Aitkenbrae" (14,256).

CLASS 29. COW in Milk, calved after 1st January 1901.—Premiums, £10, £7, and £3.

1. John M'Alister, Ardyne, Toward, "Brown Bess."
2. Robert Wilson, Manswrae, Bridge of Weir, "High Newton Susy 3rd" (16,774).

CLASS 30. COW of any age, in Calf, or HEIFER calved in 1901, in Calf and due to calve within nine months after the Show.—Premiums, £10, £7, and £3.

1. Charles Douglas, M.P., Auchlochan, Lesmahagow, "Ardyne Pride" (14,056).
2. Thomas Barr, Monkland, Kilmarnock, "White Mirly 2nd" (13,110).
3. Alexander Cross of Knockdon, Maybole, "Apple VIII" (14,694).
V. Robert Wilson, Manswrae, Bridge of Weir, "Melrose IX. of Manswrae" (14,908).

CLASS 31. HEIFER, calved in 1902.—Premiums, £10, £5, and £3.

1. James Howie, Hillhouse, Kilmarnock, "Howie's Flower of the Corn" (16,150).
2. James Howie, Hillhouse, Kilmarnock, "Howie's Sweet Monica" (16,209).
3. Andrew Mitchell, Barcheskie, Kirkcudbright, "Dorothy Drew."
V. Thomas Barr, Monkland, Kilmarnock, "Jenny 2nd of Monkland" (15,898).
H. Robert Osborne, Morton Mains, Thornhill, "Emathla" (16,347).

CLASS 32. HEIFER, calved in 1903.—Premiums, £8, £5, and £3.

1. Andrew Mitchell, Barcheskie, Kirkcudbright, "Orange Lily."
2. James Howie, Hillhouse, Kilmarnock, "Snowwreath" (17,193).
3. Robert Osborne, Morton Mains, Thornhill, "Selina Sedilia."
V. Thomas Barr, Monkland, Kilmarnock, "Aumphie 2nd."
H. Colonel G. J. Fergusson-Buchanan, of Auchentorlie, Bowling, "Lilian" (17,042).

## FAT CATTLE.

*PRESIDENT'S CHAMPION MEDAL for best Fat Animal.*

W. Stewart Menzies, Arndilly, Craigellachie, Cross, "Constance of Arndilly."

CLASS 33. OX, any pure breed or cross, calved after 1st December 1901—Premiums, £5 and £2.

1. David Arnot, Mains, Edzell, Cross, "Rufus."
2. W. S. Ferguson, Pictstonhill, Perth, Cross.
V. W. S. Ferguson, Pictstonhill, Perth, Aberdeen-Angus.

CLASS 34. OX, any pure breed or cross, calved after 1st December 1902—Premiums, £5 and £2.

1. Sir John Gilmour of Lundin and Montrave, Bart., Leven, Shorthorn and Aberdeen-Angus.
2. Sir John Gilmour of Lundin and Montrave, Bart., Leven, Shorthorn and Galloway.
V. Hon. A. D. Murray, Scones Lethendy, Perth, Cross, "Bonnie Glenshee."

CLASS 35. HEIFER, any pure breed or cross, calved after 1st December 1901—Premiums, £5 and £2.

1. W. Stewart Menzies, Arndilly, Craigellachie, Cross, "Constance of Arndilly."
2 David Arnot, Mains, Edzell, Aberdeen-Angus, "Duchess."
V. A. T. Reid, Auchterarder House, Auchterarder, Aberdeen-Angus, "Ruth 3rd of Auchterarder" (34,432).
H. Captain A. Stirling of Keir, Dunblane, Cross, "Tibbie."

CLASS 36. HEIFER, any pure breed or cross, calved after 1st December 1902—Premiums, £5 and £2.

*No Entry.*

# HORSES

*FOR AGRICULTURAL PURPOSES.*

## DRAUGHT STALLIONS.

*PRESIDENT'S CHAMPION MEDAL for best Clydesdale Stallion or Colt.*

Matthew Marshall, Bridgebank, Stranraer, "Marcellus" (11,110).

*Best Clydesdale Stallion or Colt registered in the Clydesdale Stud-Book*—Cawdor Challenge Cup, value 50 guineas, given by the Clydesdale Horse Society.

George Alston, Loudoun Hill, Darvel, "Revelanta" (11,876).

*Breeder of best Male Animal of any age in Classes* 37 *to* 40—The Silver Medal.

Matthew Marshall, Bridgebank, Stranraer.

CLASS 37. STALLION, foaled before 1901—Premiums, £20, £15, £10, and £4.

1. Matthew Marshall, Bridgebank, Stranraer, "Marcellus" (11,110).
2. Seaham Harbour Stud, Ltd., The Dene, Seaham Harbour, "Airies Prince" (10,667).
3. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Acme" (10,485).
4. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Rozelle" (10,638).
V. W. S. Park, Hatton, Bishopton, "Royal Chattan" (11,489).
H. John Crawford, Manrahead, Beith, "Casabianca" (10,523).

CLASS 38. ENTIRE COLT, foaled in 1901.—Premiums, £20, £15, £10, and £4.

1. George Alston, Loudoun Hill, Darvel, "Revelanta" (11,876).
2. William Clark, Netherlea, Cathcart, "Baron's Best" (11,597).
3. William Renwick, Meadowfield, Corstorphine, "Blackband" (11,623).
4. James Kilpatrick, Craigie Mains, Kilmarnock, "Royal Blend" (11,893).
V. David Wilkie, Newton Farm, Glencarse, "Money Kebbock" (12,254).
H. David Curr, Merrylee, Newlands, "Royal Times" (12,342).
C. Malcolm Currie, Stubblebroomhill, Kirkintilloch, "British Leader."
C. W. S. Park, Hatton, Bishopton, "Dunure Favourite" (11,692).

CLASS 39. ENTIRE COLT, foaled in 1902.—Premiums, £20, £12, £8, and £4.

1. Matthew Marshall, Bridgebank, Stranraer, "Hiawatha Gadolphin."
2. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Silver Crest" (12,358).
3. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Ruby Pride" (12,344).
4. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright, "Baron's Voucher" (12,041).
V. A. B. Matthews, Newton-Stewart, "General Hunter" (12,161).
H. John M'Nee, Afton House, Crieff, "Baron M'Nee."
C. G. & J. Cocker, Hill of Petty, Fyvie, "Abbot" (11,987).

CLASS 40. ENTIRE COLT, foaled in 1903.—Premiums, £15, £10, £6, and £4.

1. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
2. James Kilpatrick, Craigie Mains, Kilmarnock.
3. William Clark, Netherlea, Cathcart.
4. William Clark, Netherlea, Cathcart.
V. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
H. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
C. A. & W. Montgomery, Netherhall and Banks, Kirkcudbright.
C. William Wallace, Mauchline, Ayrshire, "George the First."

## DRAUGHT GELDINGS.

*PRESIDENT'S CHAMPION MEDAL for best Draught Gelding.*

William Clark, Netherlea, Cathcart, "Protection."

CLASS 41. DRAUGHT GELDING, foaled before 1901.—Premiums, £10, £5, and £3.

1. William Clark, Netherlea, Cathcart, "The General."
2. William Steven, Craigmill, Carnoustie, "Brown Robin."

CLASS 42. DRAUGHT GELDING, foaled in 1901.—Premiums, £6, £4, and £3.

1. William Clark, Wester Bogie, Kirkcaldy, "Sir Wylie."
2. J. & W. Meiklem, Begg Farm, Kirkcaldy, "Harry."
3. George Hodgson, Carlatton, Carlisle, "Champion."
V. William Clark, Netherlea, Cathcart, "Willie."
H. David Hastie & Sons, Stonefield Farm, Blantyre, "William."
C. T. M. Sharp, Drumfad, Blackford, "Jim."

CLASS 43. DRAUGHT GELDING, foaled in 1902.—Premiums, £6, £4, and £3.

1. William Clark, Netherlea, Cathcart, "Protection."
2. William Clark, Wester Bogie, Kirkcaldy, "Sir Kennedy."
3. J. & W. Meiklem, Begg, Kirkcaldy, "Jo."

## DRAUGHT MARES AND FILLIES.

*PRESIDENT'S CHAMPION MEDAL for best Clydesdale Mare or Filly.*

James Boyd of Cariskey, Southend, Kintyre, "Lady Margaret" (13,833).

*Best Clydesdale Mare or Filly registered in the Clydesdale Stud-Book*—Cawdor Challenge Cup, value 50 guineas, given by the Clydesdale Horse Society.

James Boyd of Cariskey, Southend, Kintyre, "Lady Margaret" (13,833).

*Breeder of Best Clydesdale Brood Mare*—The Robert Murdoch Prize, value £10.

William Park, Brunstane, Portobello.

CLASS 44. MARE of any age, with Foal at foot. - Premiums, £20, £12, £7, and £4.

1. William Park, Brunstane, Portobello, "Florado."
2. St Clair Cunningham, Hedderwick Hill, Dunbar, "White Heather."
3. Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Pomona."
4. Thomas Smith, Blacon Point, Chester, "Beauty's Queen."

H. David Dow, Balmanno, Bridge of Earn, "Kathleen."
C. R. & J. Kerr, Lochlane, Crieff, "Lady Albion."

*EXTRA STOCK.*

The following was Very Highly Commended, and a Medium Silver Medal awarded.

James Boyd of Cariskey, Southend, Kintyre, Campbeltown, "Topsy Pride" (15,394)

CLASS 45. YELD MARE, foaled before 1901.—Premiums, £12, £9, £6, and £4.

1. Thomas Smith, Blacon Point, Chester, "Royal Ruby."
2. J. Ernest Kerr, Harviestoun Castle, Dollar, "Baron's Blossom" (15,111).
3. George A. Calder, Anchorscross, Dunblane, "Music" (15,155).
4. Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Pyrene."

H. Earl of Rosebery, K.G., Dalmeny Park, Edinburgh, "Princess of Glasnick.
C. D. Riddell, Blackhall, Paisley, "Scottish Peeress.'

CLASS 46. YELD MARE or FILLY, foaled in 1901.—Premiums, £12, £9, £6, and £4.

1. J. Ernest Kerr, Harviestoun Castle, Dollar, "Nelly."
2. Sir John Gilmour of Lundin and Montrave, Bart., Leven, "Montrave Dorothy."
3. J. Douglas Fletcher of Rosehaugh, Avoch, N.B., "Baroness Macgregor."
4. John M'Nee, Afton House, Crieff, "Sarah Pride."

V. Thomas Smith, Blacon Point, Chester, "Baroness of Bargany."
H. A. B. Matthews, Newton-Stewart, "Queen Alexandra."
C. Mrs Weir, Newtonhead Farm, Douglas, Lanarkshire, "Montrave Mimosa."

CLASS 47. FILLY, foaled in 1902.—Premiums, £12, £9, £6, and £4.

1. Iain Ramsay, Kildalton, Port Ellen, "Lady Monday."
2. Robert Maclean, Drynie, Inverness.
3. H. M. S. Mackay, Burgie Lodge Farm, Forres, "Romola."
4. Sir John Gilmour of Lundin and Montrave, Bart., Leven, "Montrave Rosalind."

H. William M'Connell, Glasnick, Kirkcowan, "Winsome Baroness."
C. John M'Nee, Afton House, Crieff, "Sarawatha."

CLASS 48. FILLY, foaled in 1903.—Premiums, £12, £9, £6, and £4.

1. William T. Malcolm, Dunmore, by Larbert, "Favourite."
2. William Park, Brunstane, Portobello, "Rosadora."
3. Thomas Smith, Blacon Point, Chester, "Beatrice."
4. Richard Dunn, Udston, Hamilton, "Sea Foam."

V. J. Ernest Kerr, Harviestoun Castle, Dollar, "Lady Rotha."
H. William Dunlop, Dunure Mains, Ayr.
C. John M'Nee, Afton House, Crieff, "Countess of Afton."

## HUNTERS.

*PRESIDENT'S CHAMPION MEDAL for best Hunter.*

John Scott, Milkvale, Lockerbie, Gelding.

*Best Hunter Filly in Classes* 49, 50, *and* 51—Gold Medal, value £10, 10s., given by the Hunter Improvement Society.

Captain Clayhills Henderson, R.N., Invergowrie, Dundee, Filly, "Queen."

CLASS 49. COLT, GELDING, or FILLY, foaled in 1903, the produce of thoroughbred Stallions, out of Mares of any breed.—Five Prizes—£10, £7, £5, £2, and £1, given by Sir John Gilmour of Montrave, Bart.

1. Sir Reginald Ogilvy of Inverquharity, Bart., Baldovan, Strathmartine, Gelding, "Corn Kist."
2. George Dun, Woodmill, Auchtermuchty, Filly.
3. Archibald Mitchell, Airth, Larbert, Filly, "Kathleen."

CLASS 50. FILLY, MARE, or GELDING, for field, foaled in 1902, *in hand.*—Premiums, £8, £5, and £3.

1. John Scott, Milkvale, Lockerbie, Gelding.
2. Captain Clayhills Henderson, R.N., Invergowrie, Dundee, Gelding, "Blair."
3. James Carmichael of Arthurstone, Meigle, Perthshire, Gelding, "White Heather."
V. Sir R. Ogilvy, Bart., Baldovan, Strathmartine, Gelding, "Jester."
H. Donald Fraser, Bethune Arms Hotel, Markinch, Gelding, "Buller 2nd" (1261).
C. Messrs Carlyle, Milnholm, Langholm, Gelding, "Dan."

CLASS 51. YELD MARE, FILLY, or GELDING, for field, foaled in 1901, *in hand.*—Premiums, £8, £5, and £3.

1. Captain Clayhills Henderson, R.N., Invergowrie, Dundee, Filly, "Queen."
2. Sir R. Ogilvy, Bart., Baldovan, Strathmartine, Mare, "London Pride."
3. John James, Manor House, Oughterside, Maryport, Filly, "Lady Belle" (1212).
H. Donald Fraser, Bethune Arms Hotel, Markinch, Filly, "Peggie."
C. J. A. Campbell, Craigie House, Ayr, Gelding, "Tatronald."

CLASS 52. MADE HUNTERS, any age, able to carry up to 13 st.—Premiums, £15, £10, and £5.

1. W. Cecil Richard, 29 Chester Street, Edinburgh, Gelding, "Sam Weller."
2. John Scott, Milkvale, Lockerbie, Gelding, "Whitsuntide."
3. A. Alexander, Cockburn Hill, Balerno, Midlothian, Mare, "Fair Maid."

CLASS 53. MADE HUNTERS, any age, able to carry over 13 st.—Premiums, £15, £10, and £5.

1. C. M. Makgill Crichton, Lathrisk, Newton of Falkland, Gelding, "Patrick."
2. Sir John Gilmour of Lundin and Montrave, Bart., Leven, Gelding, "Brown Stout."
3. T. Taylor Scott, Lowther Street, Carlisle, Mare, "Actress" (2264).
H. William Smith Lesslie, Banchory, Kirkcaldy, Gelding, "Victor."
C. William Smith Lesslie, Banchory, Kirkcaldy, Gelding, "The Count."

CLASS 54. HUNTER BROOD MARE, with Foal at Foot or to foal this season.—Premiums, £15, £8, and £4, given by Captain Clayhills Henderson of Invergowrie, R.N.

1. George Russell, Hatton, Lundin Links, "Kathleen."
2, J. A. Campbell, Craigie House, Ayr, Mare.
3. Captain Clayhills Henderson, R.N., Invergowrie, Dundee, "Spinning Girl."

V. Donald Fraser, Bethune Arms Hotel, Markinch, "Old Sally."
H. C. H. Scott Plummer, Sunderland Hall, Selkirk, "Rags."
C. John Fraser, Glenfoot, Abernethy, "Ladybird."

### *EXTRA STOCK.*

The following was Very Highly Commended, and a Medium Silver Medal awarded.

Captain Clayhills Henderson, R.N., Invergowrie, Dundee, "Rosemary."

## HACKNEYS.

(ALL TO BE SHOWN IN HAND.)

### *PRESIDENT'S CHAMPION MEDAL for best Hackney.*

Sir Robert Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Moncreiffe Vengeance" (8249).

*Best Mare or Filly in Hackney or Pony Classes*—Champion Prize of £10, or a Gold Medal of the same value, given by the Hackney Horse Society.

E. D. M'Naughtan, Park Side, Milnthorpe, Westmoreland, "Endora" (15,764).

CLASS 55. BROOD MARE, 15 hands and upwards, with Foal at Foot or to foal this season to a registered sire. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Iain Ramsay of Kildalton, Port Ellen, Islay, "Merry May" (12,108).
2. George Wolfe, Millburn, Bathgate, "Fairfield" (7835).
3. James M'Arthur, Old Fargie, Gateside, "Result" (16,130).
V. William H. Cox, Snaigow, Murthly, "Snaigow" (12,310).

CLASS 56. BROOD MARE, under 15 hands, with Foal at Foot or to foal this season to a registered sire. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. John F. Christie, Levenfield, Alexandria, N.B., "Fiona" (10,918).
2. Sir Robert Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Moncreiffe Odd Stockings" (10,356).
3. George Wolfe, Millburn, Bathgate, "Coquette."
V. Andrew Wilson, North Mains, Stepps, "Twilight" (4819).

CLASS 57. YELD MARE or FILLY, foaled in 1901. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. Alexander Gemmell, 17 Wellington Square, Ayr, Mare, "Londesborough Nancy" (15,984).
2. Iain Ramsay, of Kildalton, Port Ellen, Islay, Filly, "St Agatha" (15,400).
3. Sir Robert Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, Filly, "Moncreiffe Idalia" (16,058),

CLASS 58. FILLY, foaled in 1902. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. E. D. M'Naughtan, Park Side, Milnthorpe, Westmoreland, 'Endora" (15,764).
2. John F. Christie, Levenfield, Alexandria, N.B., "Kiomi."
3. George Wolfe, Millburn, Bathgate, "Eldorado."

CLASS 59. FILLY, foaled in 1903, eligible for entry in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. William M'Allister, The Inverness Hackney Stud, Inverness, "Inverness Rosalice."

CLASS 60. STALLION, foaled in or before 1901, over 15 hands. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Sir Robert Moncreiffe, Bart., Moncreiffe House, Bridge of Earn, "Moncreiffe Vengeance" (8249).

CLASS 61. STALLION, foaled in or before 1901, over 14 and not over 15 hands. Registered in the Hackney Stud-Book.—Premiums, £10, £6, and £4.

1. Alexander Morton, Gowanbank, Darvel, "Lord Ossington."
2. Carr & Co., Clyde Vale Hackney Stud, Carluke, "Clyde Vale Hero."

CLASS 62. ENTIRE COLT, foaled in 1902. Registered in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. William M'Allister, The Inverness Hackney Stud, Inverness, "Inverness Imperialist" (8519).
2. Macintyre Bros., Park View, Giffen, Beith, "Limestone."

CLASS 63. ENTIRE COLT, foaled in 1903, eligible for entry in the Hackney Stud-Book.—Premiums, £8, £5, and £3.

1. James M'Arthur, Old Fargie, Gateside, "Radium."
2. John F. Christie, Levenfield, Alexandria, N.B.

## PONIES.

*PRESIDENT'S CHAMPION MEDAL for best Pony.*

Thomas Smith, Shirley Stud, Hall Green, near Birmingham, "Pinderfields Horace" (7952).

CLASS 64. STALLION, 3 years old and upwards, over 12, not exceeding 14 hands, *in hand*.—Premiums, £5, £3, and £2.

1. Thomas Smith, Shirley Stud, Hall Green, near Birmingham, "Pinderfields Horace" (7952).
2. Carr & Co., Clyde Vale Stud, Carluke, "Woodlands Eaglet" (8339).
3. Alexander Gemmell, 17 Wellington Square, Ayr.
V. Andrew Wilson, North Mains, Stepps, "Carleton Wonder" (7396).

CLASS 65. STALLION, 3 years old and upwards, 12 hands and under, *in hand*.—Premiums, £5, £3, and £2.

1. Carr & Co., Clyde Vale Stud, Carluke, N.B., "Berkeley Bantam" (7360).

CLASS 66. YELD MARE, FILLY, or GELDING, 3 years old and upwards, over 13 and not over 14 hands, *in saddle*.—Premiums, £5, £3, and £2.

1. Carr & Co., Clyde Vale Stud, Carluke, N.B., Mare, "Queen of the Bangs."
2. A. S. M'Arthur, 23 Princes Street, Perth, Gelding, "Duke of Perth."
3. A. S. M'Arthur, 23 Princes Street, Perth, Mare, "Dorothea."

CLASS 67. YELD MARE, FILLY, or GELDING, 3 years old and upwards, over 12 and not over 13 hands, *in saddle*.—Premiums, £5, £3, and £2.

1. John Lauder, Invercloy, Mill of Keir, Dunblane, Gelding, "Lord Bobs."

CLASS 68. YELD MARE, FILLY, or GELDING, 3 years old and upwards, 12 hands and under, *in saddle*.—Premiums, £5, £3, and £2.

1. John Lauder, Invercloy, Mill of Keir, Dunblane, Gelding, "Peter."
2. John Lauder, Invercloy, Mill of Keir, Dunblane, Mare, "Lady Peggie."

## POLO AND RIDING PONIES.

*PRESIDENT'S CHAMPION MEDAL for best Polo or Riding Pony.*

Marquis of Tullibardine, M.V.O., D.S.O., Blair-Atholl, Arab Stallion, "Mahmud."

CLASS 69. STALLION, 3 years old and upwards, 13.2 and not exceeding 14.2 hands, entered in the Polo and Riding Pony Stud-Book, or got by a Registered Polo Pony sire or out of a Registered Polo Pony dam.—Premiums, £5, £3, and £2.

1. Marquis of Tullibardine, M.V.O., D.S.O., Blair-Atholl, "Rooiwaal."
2. Sir George Bullough, Kinloch Castle, Isle of Rum, by Oban, "Birmingham Royal" (127).
3. J. H. Munro Mackenzie, Calgary, Isle of Mull, "The Syrian" (110).
V. Captain C. G. G. Hutchison, 21st Lancers, Balmaghie, Castle Douglas, N.B., "De Wet" (218).

*EXTRA STOCK.*

The following was Very Highly Commended, and a Medium Silver Medal awarded.

Marquis of Tullibardine, M.V.O., D.S.O., Blair-Atholl, Arab Stallion, "Mahmud."

CLASS 70. YELD MARE, FILLY, or GELDING, 3 years old or upwards, 13.2 and not exceeding 14.2 hands, entered in the Polo and Riding Pony Stud-Book, or got by a Registered Polo Pony sire, or out of a Registered Polo Pony dam.—Premiums, £5, £3, and £2.

1. Marquis of Tullibardine, M.V.O., D.S.O., Blair-Atholl, Mare, "Mary."
2. J. H. Munro Mackenzie, Calgary, Isle of Mull, Gelding, "Silver Wedding."

## HIGHLAND PONIES.

*PRESIDENT'S CHAMPION MEDAL for best Highland Pony.*

The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Bonnie Laddie."

*Best Stallion or Entire Colt in Classes* 71 *and* 72—Special Prize of £5, 5s., given by the Polo and Riding Pony Society.

The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Bonnie Laddie."

CLASS 71. HIGHLAND PONY STALLION, 3 years old or upwards, not exceeding 14.2 hands, entered or accepted for entry in the Highland Section of the Polo Pony Stud-Book.—Premiums, £5, £3, and £2.

1. The Duke of Atholl, K.T., Blair Castle, Blair-Atholl, "Bonnie Laddie."
2. Lord Arthur Cecil, The Mount, Lymington, Hants, "Skene Dhu."
3. Lord Arthur Cecil, The Mount, Lymington, Hants, "Whitefoot."
V. Graham Hutchison of Balmaghie, Castle-Douglas, N.B., "Arran" (251).

CLASS 72. HIGHLAND PONY ENTIRE COLTS, foaled in 1902 or 1903.—Premiums, £5, £3, and £2.

1. Donald Stewart, Drumchorry, Pitlochry, "Glen Bruar."
2. W. Dalziel Mackenzie of Farr and Newbie, Farr House, Daviot, Inverness "Beaufort."
3. James Stewart-Robertson, Edradynate, Strathtay, "Ferragon."

*Best Mare in Class* 73—Special Prize of £5, 5s. given by the Polo and Riding Pony Society.

Peter Cameron, Over Balchandy, Pitlochry, "Maggie."

CLASS 73. HIGHLAND PONY MARE, 3 years old or upwards, not exceeding 14.2 hands, Yeld or with Foal at foot, entered or accepted for entry in the Highland Section of the Polo Pony Stud-Book.—Premiums, £5, £3, and £2.

1. Peter Cameron, Over Balchandy, Pitlochry, "Maggie."
2. Donald Stewart, Drumchorry, Pitlochry, "Mountain Polly."
3. Lord Willoughby D'Eresby, Glen Artney Forest, Comrie, "Jenny."
V. Donald Stewart, Drumchorry, Pitlochry, "Mountain Maid."
H. Lord Arthur Cecil, The Mount, Lymington, Hants, "Lily."

## SHETLAND PONIES.

(ALL TO BE SHOWN IN HAND.)

*PRESIDENT'S CHAMPION MEDAL for best Shetland Pony.*

Walter Aitchison, Coniecleugh, Huntly, "Strawberry."

CLASS 74. STALLION, not exceeding 10½ hands, foaled before 1901.—Premiums, £5, £3, and £2.

1. J. Douglas Fletcher of Rosehaugh, Avoch, N.B., "Merry Hero" (244).
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Bellman."
3. Walter Aitchison, Coniecleugh, Huntly, "Norman."
V. R. W. R. Mackenzie, Earlshall, Leuchars, "Steinas."
H. Charles Douglas, M.P., Auchlochan, Lesmahagow, "Eric."
C. Miss J. T. Irvine Fortescue, Kingcausie, Aberdeen, "Master Fly" (243).

CLASS 75. ENTIRE COLT, not exceeding 10½ hands, foaled in 1901 or 1902.—Premiums, £5, £3, and £2.

1. R. W. R. Mackenzie, Earlshall, Leuchars, "Duke."
2. Miss Mary Nicol, Roscobie, Banchory, "Titmouse."
3. William Mungall of Transy, Dunfermline, "Seaweed."
V. George A. Miller, Lawmuir, Methven, "Hamish."
H. R. W. R. Mackenzie, Earlshall, Leuchars, "Marquis."

CLASS 76. MARE, not exceeding 10½ hands, with Foal at foot.—Premiums, £5, £3, and £2.

1. R. W. R. Mackenzie, Earlshall, Leuchars, "Petite" (1196).
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Bracelet."
3. Lady Waldie Griffith, Hendersyde Park, Kelso, "Virtuous."
V. William Mungall of Transy, Dunfermline, "Princess of Wales" (1615).
H. Miss J. T. Irvine Fortescue, Kingcausie, Aberdeen, "Jane" (1656).
C. George A. Miller, Lawmuir, Methven, "Baroness Bobs."
C. George A. Miller, Lawmuir, Methven, "Ladysmith."

CLASS 77. YELD MARE, not exceeding 10½ hands.—Premiums, £5, £3, and £2.

1. Walter Aitchison, Coniecleugh, Huntly, "Strawberry."
2. William Mungall of Transy, Dunfermline, "Stella."
3. George A. Miller, Lawmuir, Methven, "Lavrock" (1200).
V. George A. Miller, Lawmuir, Methven, "Beatrice" (1583).
H. William Little, Gladenholm, Amisfield, R.S.O., Dumfriesshire "Speedwell."
C. George A. Miller, Lawmuir, Methven, "My Lady" (1355).

CLASS 78. FILLY, not exceeding 10½ hands, foaled in 1901 or 1902.—Premiums, £5, £3, and £2.

1. Miss Mary Nicol, Roscobie, Banchory, N.B., "Freda."
2. R. W. R. Mackenzie, Earlshall, Leuchars, "Blue Bell."
3. Charles Douglas, M.P., Auchlochan, Lesmahagow, "Darzia."
V. William Mungall of Transy, Dunfermline, "Silver Bell."
H. George A. Miller, Lawmuir, Methven, "Hermia."
C. William Mungall of Transy, Dunfermline, "Dagmar."

## DRIVING COMPETITIONS.

*PRESIDENT'S CHAMPION MEDAL for best animal in the Classes for Horses in Harness.*

John Nairn, Forth Park, Kirkcaldy, Gelding, "Lord Dazzler."

CLASS 79. YELD MARE, FILLY, or GELDING, in Harness, 15 hands and upwards, to be driven in the ring.—Premiums, £20, £10, and £5.

1. John Nairn, Forth Park, Kirkcaldy, Gelding, "Lord Dazzler."
2. Carr & Co., Clyde Vale Stud, Carluke, Gelding, "Clyde Vale Swell."
3. William Scott, Thornhome, Carluke, N.B., Mare, "Bryony."

CLASS 80. YELD MARE, FILLY, or GELDING, in Harness, under 15 hands, to be driven in the ring.—Premiums, £20, £10, and £5.

1. William Scott, Thornhome, Carluke, N.B., Gelding, "Lord Jersey."
2. Alex. Morton, Gowanbank, Darvel, Ayrshire, Gelding, "Triumph."
3. A. S. M'Arthur, 23 Princes Street, Perth, Gelding, "Duke of Perth."

## JUMPING COMPETITIONS

*Wednesday, 20th July.*

CLASS 1. HORSES or PONIES, any height.—Premiums, £20, £15, £10, £5, and £3.

1. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Hardcash."
2. Simon Andrews & Sons, Cardonald Grain Mills, Crookston, Gelding, "Ping Pong."
3. James Nodwell, New George Hotel, Dumfries, Gelding, "High Life."
4. Dalgety Brothers, Park Place, Dundee, Gelding, "The Joker."
5. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Rufus."

*Thursday, 21st July.*

CLASS 2. HORSES or PONIES, any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in Class 1.—Premiums, £10, £5, £5, £3, and £2.

1. J. Wheeler, Shakespeare Farm, Studley, Mare, "Confidence."
2. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Rufus."
3. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Hardcash."
4. Dalgety Brothers, Park Place, Dundee, Gelding, "The Joker."
5. Simon Andrews & Sons, Cardonald Grain Mills, Crookston, Gelding, "Ping Pong."

*Friday, 22nd July.*

CLASS 3. HORSES or PONIES, any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in either of Classes 1 or 2—4 inches extra for the winner of the two first prizes in Classes 1 and 2.—Premiums, £10, £8, £5, £3, and £2.

1. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Rufus."
2. Simon Andrews & Sons, Cardonald Grain Mills, Crookston, Gelding, "Ping Pong."
3. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Hardcash."
4. Captain L. B. Moubray of Otterston, Aberdour, Fife, Mare, "Little Mary."
5. Captain L. B. Moubray of Otterston, Aberdour, Fife, Gelding, "Greyfriar."

*Thursday Evening, 21st July.*

CLASS. 4. HORSES or PONIES, any height.—Premiums, £10, £5, £3, and £2.

1. F. V. Grange, Oak House, Farndon, Chester, Gelding, "Rufus."
2. Simon Andrews & Sons, Cardonald Grain Mills, Crookston, Gelding, "Ping Pong."
3. J. Wheeler, Shakespeare Farm, Studley, Mare, "Confidence."
4. D. Carnegie, East Pitcorthie, Colinsburgh, Gelding, "Black Jock."

*Champion Prize of £10 for most points in Prizes with one or more Horses in above Classes*—First Prize to count five points; Second Prize, four points; Third Prize, three points; Fourth Prize, two points; and Fifth Prize, one point—the money to be evenly divided in the event of a tie.

F. V. Grange, Oak House, Farndon, Chester.

## SHEEP

### BLACKFACED.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Blackfaced Sheep.*

J. Archibald, Overshiels, Stow.

CLASS 81. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. J. Archibald, Overshiels, Stow.
2. James Hamilton, Woolfords, Cobbinshaw.
3. Archibald and Donald M'Dougall, Claggan, Killin.
4. Cadzow Brothers, Borland, Carstairs Junction.
V. James Murray, Low Plowland, by Darvel.
H. Charles Howatson of Glenbuck.
C. Archibald and Donald M'Dougall, Claggan, Killin.

CLASS 82. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. J. Archibald, Overshiels, Stow.
2. James Clark of Nunland, Crossflatt, Muirkirk.
3. James Hamilton, Woolfords, Cobbinshaw.
4. Cadzow Brothers, Borland, Carstairs Junction.
V. J. Archibald, Overshiels, Stow.
H. Cadzow Brothers, Borland, Carstairs Junction.
C. Cadzow Brothers, Borland, Carstairs Junction.

CLASS 83. EWE, above one Shear, with her Lamb at foot.—
Premiums, £10, £5, and £2.

1. James Clark of Nunland, Crossflatt, Muirkirk.
2. Cadzow Brothers, Borland, Carstairs Junction.
3. John Miller, Lambhill, Strathaven.
V. Villar & Jackson, Mayshiel, Duns.
H. C. L. Wood of Freeland, Forgandenny, Perth.

CLASS 84. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. A. & D. M'Dougall, Claggan, Killin.
2. Cadzow Brothers, Borland, Carstairs Junction.
3. Cadzow Brothers, Borland, Carstairs Junction.
V. Villar & Jackson, Mayshiel, Duns.
H. John Millar, Lambhill, Strathaven.

### CHEVIOT.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Cheviot Sheep.*

John Elliot, Hindhope, Jedburgh.

*Challenge Cup, value £25, for best Sheep in the Cheviot Classes*—Given by the Cheviot Sheep Society.

John Elliot, Hindhope, Jedburgh.

CLASS 85. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. John Elliot, Hindhope, Jedburgh.
3. J. R. C. Smith, Mowhaugh, Yetholm.
4. John Elliot, Hindhope, Jedburgh.
V. Jacob Robson, Byrness, Otterburn, Northumberland, "Prince Charming."
H. A. & James K. Smith, Leaston, Upper Keith, "Donald Innes."
C. J. R. C. Smith, Mowhaugh, Yetholm.

CLASS 86. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. John Robson, Newton, Bellingham.
2. John Robson, Newton, Bellingham.
3. John Elliot, Hindhope, Jedburgh.
4. John Elliot, Hindhope, Jedburgh.
V. J. R. C. Smith, Mowhaugh, Yetholm.
H. J. R. C. Smith, Mowhaugh, Yetholm.
C. J. R. C. Smith, Mowhaugh, Yetholm.
C. John Murray, Parkhall, Douglas.

CLASS 87. EWE, above one Shear, with her Lamb at foot.—
Premiums, £10, £5, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. John Robson, Newton, Bellingham.
3. Jacob Robson, Byrness, Otterburn, Northumberland.
V. Matthew S. M'Kerrow, Boreland of Southwick, Dumfries.
H. A. & James K. Smith, Leaston, Upper Keith
C. Jacob Robson, Byrness, Otterburn, Northumberland.

CLASS 88. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. John Elliot, Hindhope, Jedburgh.
2. Jacob Robson, Byrness, Otterburn, Northumberland.
3. J. R. C. Smith, Mowhaugh, Yetholm.
V. Matthew S M'Kerrow, Boreland of Southwick, Dumfries.
H. J. R. C. Smith, Mowhaugh, Yetholm.
C. Matthew S. M'Kerrow, Boreland of Southwick, Dumfries
C. Matthew S. M'Kerrow, Boreland of Southwick, Dumfries.
C. John Robson, Newton, Bellingham.
C. A. & James K. Smith, Leaston, Upper Keith.

## BORDER LEICESTER.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Border Leicesters.*

David Hume, Barrelwell, Brechin, "45 F."

*THE TWEEDDALE GOLD MEDAL, value £20, for best Border Leicester Tup.*

David Hume, Barrelwell, Brechin, "45 F."

CLASS 89. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. The Right Hon. A. J. Balfour, Whittingehame, Prestonkirk.
2. William Scott, Thornhome, Carluke, "Leaston Chief" (1078).
3. Robert Taylor, Pitlivie Farm, Carnoustie, "Pitlivie Mayor" (1116).
4. W. S. Ferguson, Pictstonhill, Perth, "Aberdeen Champion" (983).
V. A. Cameron & Sons, Westside Farm, Brechin.

CLASS 90. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. David Hume, Barrelwell, Brechin, "45 F."
2. Thomas Clark, Oldhamstocks Mains, Cockburnspath.
3. William Scott, Thornhome, Carluke.
4. Thomas Clark, Oldhamstocks Mains, Cockburnspath.

V. T. M'Intosh, Knowhead, Brechin.
H. David Hume, Barrelwell, Brechin, "90 F."
C. The Right Hon. A. J. Balfour, Whittingehame, Prestonkirk.

CLASS 91. EWE, above one Shear.—Premiums, £10, £5, and £2.

1. William Scott, Thornhome, Carluke.
2. The Duke of Buccleuch and Queensberry, K.G., K.T., Dalkeith Park, Dalkeith.
3. J. & J. R. C. Smith, Galalaw, Kelso.
V. Robert Taylor, Pitlivie Farm, Carnoustie, "E 7."
H. The Right Hon. A. J. Balfour, Whittingehame, Prestonkirk.
C. The Right Hon. A. J. Balfour, Whittingehame, Prestonkirk.

CLASS 92. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. David Hume, Barrelwell, Brechin "66 F."
2. J. & J. R. C. Smith, Galalaw, Kelso.
3. J. & J. R. C. Smith, Galalaw, Kelso.
V. William Scott, Thornhome, Carluke.
H. T. M'Intosh, Knowhead, Brechin.
C. The Duke of Buccleuch and Queensberry, K.G., K.T., Dalkeith Park, Dalkeith.

## HALF-BRED.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Half-Breds.*

A. & James K. Smith, Leaston, Upper Keith.

CLASS 93. TUP, above one Shear.—Premiums, £12, £8, £4, and £2.

1. John Bertram, Addinston, Lauder.
2. John Bertram, Addinston, Lauder.
3. James A. W. Mein, Hunthill, Jedburgh.

CLASS 94. SHEARLING TUP.—Premiums, £12, £8, £4, and £2.

1. A. & James K. Smith, Leaston, Upper Keith.
2. John Bertram, Addinston, Lauder.
3. John Bertram, Addinston, Lauder.
4. Robert Dickinson, Longcroft, Lauder.
V. A. & James K. Smith, Leaston, Upper Keith.

CLASS 95. EWE, above one Shear.—Premiums, £10, £5, and £2.

1. Alexander Brown, Incharvie, Kilconquhar, Fife.
2. James A. W. Mein, Hunthill, Jedburgh.
3. James A. W. Mein, Hunthill, Jedburgh.
V. James A. W. Mein, Hunthill, Jedburgh.

CLASS 96. SHEARLING EWE or GIMMER.—Premiums, £10, £5, and £2.

1. A. & James K. Smith, Leaston, Upper Keith.
2. James A. W. Mein, Hunthill, Jedburgh.
3. A. & James K. Smith, Leaston, Upper Keith.
V. James A. W. Mein, Hunthill, Jedburgh.

## SHROPSHIRE.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Shropshires.*

R. P. Cooper, Shenstone Court, Lichfield.

CLASS 97. TUP, above one Shear.—Premiums, £6, £4, and £2.

1. R. P. Cooper, Shenstone Court, Lichfield.
2. Thomas A. Buttar, Corston, Coupar-Angus.
3. Sir Walter O. Corbet, Bart., Acton Reynold, Shrewsbury, "Reynold Guardsman."
C. Thomas A. Buttar, Corston, Coupar-Angus.

CLASS 98. SHEARLING TUP.—Premiums, £6, £4, and £2.

1. R. P. Cooper, Shenstone Court, Lichfield.
2. Thomas A. Buttar, Corston, Coupar-Angus.
3. Sir Walter O. Corbet, Bart., Acton Reynold, Shrewsbury.
H. Thomas A. Buttar, Corston, Coupar-Angus.
C. Thomas A. Buttar, Corston, Coupar-Angus.
C. Thomas A. Buttar, Corston, Coupar-Angus.

CLASS 99. EWE, above one Shear.—Premiums, £5, £3, and £2.

1. Thomas A. Buttar, Corston, Coupar-Angus.
2. R. P. Cooper, Shenstone Court, Lichfield.
3. Sir Walter O. Corbet, Bart., Acton Reynold, Shrewsbury.
H. Thomas A. Buttar, Corston, Coupar-Angus.
H. R. P. Cooper, Shenstone Court, Lichfield.

CLASS 100. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2.

1. R. P. Cooper, Shenstone Court, Lichfield.
2. Sir Walter O. Corbet, Bart., Acton Reynold, Shrewsbury.
3. Thomas A. Buttar, Corston, Coupar-Angus.
H. R. P. Cooper, Shenstone Court, Lichfield.

## OXFORD DOWNS.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Oxford Downs.*

James T. Hobbs, Maisey Hampton, Fairford, Gloucester.

CLASS 101. SHEARLING TUP.—Premiums, £6, £4, and £2.

1. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.
2. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.
3. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.

CLASS 102. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2

1. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.
2. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.
3. James T. Hobbs, Maisey Hampton, Fairford, Gloucester.

## SUFFOLK.

*PRESIDENT'S CHAMPION MEDAL for best Pen of Suffolk Sheep.*

Alexander Anderson, Berryhill, Dundee.

CLASS 103. SHEARLING TUP.—Premiums, £6, £4, and £2.

Alexander Anderson, Berryhill, Dundee.

*Best Suffolk Ewe in Class* 104 *bred in Scotland*—£3; *second best ditto*, £2.
Given by the Suffolk Sheep Society.

1. William Ford, Fentonbarns, Drem.
2. William Kennedy, Luce Mains, Ecclefechan.

CLASS 104. SHEARLING EWE or GIMMER.—Premiums, £5, £3, and £2.

1. Alexander Anderson, Berryhill, Dundee.
2. Alexander Anderson, Berryhill, Dundee.
3. William Ford, Fentonbarns, Drem.
H. Alexander Anderson, Berryhill, Dundee.

*Best Pen of Suffolk Ewe Lambs in Class* 105 *bred in Scotland*—£3; *second best ditto*, £2. Given by the Suffolk Sheep Society.

William Ford, Fentonbarns, Drem.

CLASS 105. THREE EWE LAMBS, uncoloured and untrimmed, except as to the squaring of the tail.—Premiums, £5, £3, and £2, given by the Suffolk Sheep Society.

1. William Ford, Fentonbarns, Drem.
2. Alexander Anderson, Berryhill, Dundee.
3. Alexander Anderson, Berryhill, Dundee.

## FAT SHEEP.

CLASS 106. THREE FAT SHEARLING EWES or WETHERS, out of Blackfaced Ewes, and got by Border Leicester or other Tup.—£3, £2, per Mr W. S. Ferguson, Pictstonhill, Perth.

1. Sir John Gilmour of Lundin and Montrave, Bart., Leven (Leicester Tup).
2. William Marshall, Glenwhommie, Dunblane (Leicester Tup).
V. Alexander Brown, Incharvie, Kilconquhar, Fife (Leicester Tup).
H. Hon. A. D. Murray, Scones Lethendy, Perth (Leicester Tup).
C. Sir John Gilmour of Lundin and Montrave, Bart., Leven (Leicester Tup).

CLASS 107. THREE FAT SHEARLING Cross-bred EWES or WETHERS, out of Ewes of any breed other than Blackfaced, and got by Tup of a different breed from the Ewes.—£3, £2, per Mr W. S. Ferguson, Pictstonhill, Perth.

1. William Ford, Fentonbarns, Drem (Suffolk Tup and Half-bred Ewes).
2. Alexander Brown, Incharvie, Kilconquhar, Fife (Shropshire Tup and Half-bred Ewes).
V. The Earl of Mansfield, Balboughty, Perth (Oxford Tup and Half-bred Ewes).
H. Hon. A. D. Murray, Scones Lethendy, Perth (Suffolk Tup and Leicester Ewes).

## EXTRA SECTIONS.

*Best Pen of Lambs in Class* 108 *got by a Suffolk Tup, and out of Cheviot or Blackfaced Ewes.*—Prize of £5, given by the Suffolk Sheep Society.

William Kennedy, Luce Mains, Ecclefechan (Suffolk Tup and Cheviot and Blackfaced Ewes).

*Best Pen of Lambs in Class* 108 *got by a Suffolk Tup, and out of Border Leicester, Half-bred, or Three-parts-bred Ewes.*—Prize of £5, given by the Suffolk Sheep Society.

The Duke of Leeds, Hornby Castle, Bedale (Suffolk Tup and Border Leicester Ewes).

*Best Pens of Cross-bred Lambs in Class* 108 *got by an Oxford Down Tup.*—Prizes of £5, £3, and £2, given by Oxford Down Sheep-Breeders' Association.

Alexander Anderson, Berryhill, Dundee (Oxford Down Tup and Hampshire Ewes).

*Best Pens of Cross-bred Lambs in Class* 108 *got by a Shropshire Tup.*—Prizes of £5, £3, and £2, given by Scotch Breeders of Shropshire Sheep.

1. Alexander Anderson, Berryhill, Dundee (Shropshire Tup and Dorset Horn Ewes).
2. Alexander Brown, Incharvie, Kilconquhar, Fife (Shropshire Tup and Half-bred Ewes).

CLASS 108. Five FAT LAMBS, any Breed or Cross, dropped in the year of the Show.—Premiums, £5 and £3.

1. Alexander Anderson, Berryhill, Dundee (Oxford Down Tup and Hampshire Ewes).
2. Alexander Anderson, Berryhill, Dundee (Shropshire Tup and Dorset Horn Ewes).
V. Alexander Brown, Incharvie, Kilconquhar, Fife (Shropshire Tup and Half-bred Ewes).
H. The Duke of Leeds, Hornby Castle, Bedale (Suffolk Tup and Border Leicester Ewes).

# SWINE

*PRESIDENT'S CHAMPION MEDAL for best Pen of Swine.*

R. Millington Knowles, Colston Bassett Hall, Bingham, Notts, Large White Sow, "Colston Lass" (11,216).

## LARGE WHITE BREED.

CLASS 109. BOAR.—Premiums, £6, £4, and £2.

1. Earl of Ellesmere, Worsley Hall, Manchester, "Roger" (7203).
2. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Daily."
3. Earl of Ellesmere, Worsley Hall, Manchester, "Worsley Eclipse" (6647).
V. R. Millington Knowles, Colston Bassett Hall, Bingham, Notts, "Vanguard" (7261).
H. William B. Wallace, Broomhouse, Corstorphine, Mid-Lothian, "Broomhouse Monarch" (7609).

CLASS 110. SOW.—Premiums, £6, £4, and £2.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Empress C."
2. Earl of Ellesmere, Worsley Hall, Manchester, "Worsley Paraquet" (11,794).
3. R. Millington Knowles, Colston Bassett Hall, Bingham, Notts, "Colston Lady Frost" (11,218).
H. William B. Wallace, Broomhouse, Corstorphine, Mid-Lothian, "Colston Lass II" (11,222).

*EXTRA STOCK.*

The following was Very Highly Commended, and a Medium Silver Medal awarded.

R. Millington Knowles, Colston Bassett Hall, Bingham, Notts, Sow, "Colston Lass" (11,216).

CLASS 111. Three PIGS, not above 8 months old.—Premiums, £5, £3, and £2.

1. Earl of Ellesmere, Worsley Hall, Manchester.
2. Earl of Ellesmere, Worsley Hall, Manchester.
3. William B. Wallace, Broomhouse, Corstorphine.

## WHITE BREED OTHER THAN LARGE.

CLASS 112. BOAR.—Premiums, £6, £4, and £2.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Middleton."

CLASS 113. SOW.—Premiums, £6, £4, and £2.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts, "Holywell Barbara."

CLASS 114. Three PIGS, not above 8 months old.—Premiums, £5, £3, and £2.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts.

## BERKSHIRE.

CLASS 115. BOAR.—Premiums, £6, £4, and £2.

1. J. Jefferson, Peel Hall, Chester, "Peel Champion."
2. The Duchess of Devonshire, Compton Place, Eastbourne, "Polegate Dignity."
3 The Duchess of Devonshire, Compton Place, Eastbourne, "Polegate Doctor."
V. J. Jefferson, Peel Hall, Chester.
H. J. Jefferson, Peel Hall, Chester, "M'Kinley" (8533).

CLASS 116. SOW.—Premiums, £6, £4, and £2.

1. The Duchess of Devonshire, Compton Place, Eastbourne, "Polegate Decoy."
2. J. Jefferson, Peel Hall, Chester, "Peel Elsie" (9797).

3. J. Jefferson, Peel Hall, Chester.
V. J. Jefferson, Peel Hall, Chester, "St Valentine's Day" (9057).
H. The Duchess of Devonshire, Compton Place, Eastbourne, "Polegate Dame."
C. The Duke of Leeds, Hornby Castle, Bedale, Yorks, "Hornby Dorothy" (9463).

CLASS 117. Three PIGS, not above 8 months old.—Premiums, £5, £3, and £2.

1. J. Jefferson, Peel Hall, Chester.
2. The Duchess of Devonshire, Compton Place, Eastbourne.
3. The Duke of Leeds, Hornby Castle, Bedale, Yorks.

## POULTRY

First Premium—*One Sovereign.* Second Premium—*Ten Shillings.* Where there are Six or more Entries, Third Premium—*Five Shillings.*

### CHAMPION MEDALS.

1. *Best Cock, any variety.*

Arthur C. Major, Ditton, Langley, Slough, Bucks.

2. *Best Hen, any variety.*

Alexander M. Prain, Rawes, Longforgan.

3. *Best Cockerel, any variety.*

Viscount Deerhurst, Dynes Hall, Halstead, Essex.

4. *Best Pullet, any variety.*

Henry Pickles, Kayfield House, Earby.

5. *Best Pen of Ducks.*

The Countess of Home, The Hirsel, Coldstream.

6. *Best Pen of Geese.*

James Dow, Clathybeg, Auchterarder.

7. *Best Pen of Turkeys.*

Miss Shanks, Cuthelton Farm, Denny.

CLASS 1. DORKING—Coloured. Cock.

1. Miss Shanks, Cuthelton Farm, Denny.
2. J. T. Cathcart, Dunbog House, Newburgh.
3. The Countess of Home, The Hirsel, Coldstream.
V. J. T. Cathcart, Dunbog House, Newburgh.
H. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
H. Alexander M. Prain, Rawes, Longforgan.
C. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr.

CLASS 2. DORKING—Coloured. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
3. The Countess of Home, The Hirsel, Coldstream.
V. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
V. Miss Shanks, Cuthelton Farm, Denny.
H. William Marshall, Glenwhommie, Dunblane.
H. John Mechie, jun., Miller, Auchtermuchty.
C. J. T. Cathcart, Dunbog House, Newburgh.
C. William Marshall, Glenwhommie, Dunblane.

CLASS 3. DORKING—Coloured. Cockerel.

1. Charles Aitkenhead, Stud Farm, Seaham Harbour.
2. William Marshall, Glenwhommie, Dunblane.
3. J. T. Cathcart, Dunbog House, Newburgh.
V. James Glen, 5 West Breast, Greenock.
V. Charles Aitkenhead, Stud Farm, Seaham Harbour.
H. The Countess of Home, The Hirsel, Coldstream.
V. J. P. Strachan, Stoneywood, Aberdeenshire.
C. James Glen, 5 West Breast, Greenock.

CLASS 4. DORKING—Coloured. Pullet.

1. Alexander M. Prain, Rawes, Longforgan.
2. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
3. Charles Aitkenhead, Stud Farm, Seaham Harbour.
V. James Glen, 5 West Breast, Greenock.
V. William Marshall, Glenwhommie, Dunblane.
V. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr.
H. J. T. Cathcart, Dunbog House, Newburgh.
C. James Glen, 5 West Breast, Greenock.
C. William Marshall, Glenwhommie, Dunblane.

CLASS 5. DORKING—Silver Grey. Cock.

1. Arthur C. Major, Ditton, Langley, Slough, Bucks.
2. James Glen, 5 West Breast, Greenock.
3. James Shanks, Cuthelton Farm, Denny.
V. The Countess of Home, The Hirsel, Coldstream.
V. George M'Bain, Linkwood, Elgin.
V. John Mechie, jun., Miller, Auchtermuchty.
H. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
H. Robert Reid, Auchtermuchty.
C. The Earl of Rosebery, K.G , Dalmeny Park, Edinburgh.

CLASS 6. DORKING—Silver Grey. Hen.

1. George M'Bain, Linkwood, Elgin.
2. John Howie, Burns, Tarbolton, Ayr.
3. Arthur C. Major, Ditton, Langley, Slough, Bucks.
V. James Reid, Kilnheugh, Auchtermuchty.
C. James M'Leish, Bootmaker, Bankfoot.
C. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.

CLASS 7. DORKING—Silver Grey. Cockerel.

1. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
2. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.
3. Malcolm S. Speir, Culdees, Muthill, Perthshire.
V. George M'Bain, Linkwood, Elgin.
H. George M'Bain, Linkwood, Elgin.

CLASS 8. DORKING—Silver Grey. Pullet.

1. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
2. George M'Bain, Linkwood, Elgin.
3. George M'Bain, Linkwood, Elgin.
V. Charles Aitkenhead, Stud Farm, Seaham Harbour.
V. John Mechie, jun., Miller, Auchtermuchty.
H. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.

CLASS 9. COCHIN-CHINA. Cock.

1. John Ferguson, 7 North Inglis Street, Dunfermline.
2. R. M'Millan, Main Street, Barrhead.
V. John Ferguson, 7 North Inglis Street, Dunfermline.
V. William Good, Portland Park, Hamilton.

### CLASS 10. COCHIN-CHINA. Hen.

1. R. M'Millan, Main Street, Barrhead.
2. George Archibald, Blebo Crags, by Cupar-Fife.
V. John Ferguson, 7 North Inglis Street, Dunfermline.
V. William Good, Portland Park, Hamilton.

### CLASS 11. BRAHMAPOOTRA. Cock.

1. Lady Gordon Cumming, Altyre House, Forres.
2. Thomas Gardner, Wraes Mill, Neilston.
V. George Archibald, Blebo Crags, by Cupar-Fife.
V. George Archibald, Blebo Crags, by Cupar-Fife.

### CLASS 12. BRAHMAPOOTRA. Hen.

1. The Countess of Home, The Hirsel, Coldstream.
2. John Walker, 13 Front Lebanon, Cupar-Fife.
V. Andrew Pearson, Burnside, Elgin.
V. G. C. Taylor, The Grove, Downfield, Dundee.
H. G. C. Taylor, The Grove, Downfield, Dundee.

### CLASS 13 BRAHMA or COCHIN. Cockerel.

1. John Ferguson, 7 North Inglis Street, Dunfermline (Cochin).

### CLASS 14. BRAHMA or COCHIN. Pullet.

1. The Countess of Home, The Hirsel, Coldstream (Brahma).
2. John Ferguson, 7 North Inglis Street, Dunfermline (Cochin).
V. John Ferguson, 7 North Inglis Street, Dunfermline (Cochin).
V. William Good, Portland Park, Hamilton (Cochin).

### CLASS 15. SCOTCH GREY. Cock.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2. John Robertson, Schawpark, Alloa.
V. John Carswell, 148 Graham's Road, Falkirk.

### CLASS 16. SCOTCH GREY. Hen.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2. John Carswell, 148 Graham's Road, Falkirk.
V. A. Beardsley, Cardonald, Glasgow.

### CLASS 17. SCOTCH GREY. Cockerel.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire.
2. A. Beardsley, Cardonald, Glasgow.
V. John Carswell, 148 Graham's Road, Falkirk.
V. John Robertson, Schawpark, Alloa.

### CLASS 18. SCOTCH GREY. Pullet.

1. A. Beardsley, Cardonald, Glasgow.
2. John Carswell, 148 Graham's Road, Falkirk
V. David Hastings, Glaister Cottage, Darvel, Ayrshire

### CLASS 19. HAMBURG—Black. Cock.

1. Henry Pickles, Kayfield House, Earby.
2. The Countess of Home, The Hirsel, Coldstream.

### CLASS 20. HAMBURG—Black. Hen.

1. Henry Pickles, Kayfield House, Earby.
2. George Gibb, Maybank, East Calder.
V. John F. Forsyth, jun., Clackmannan.
V. The Countess of Home, The Hirsel, Coldstream.
H. William Kerr, Bandeath, Stirling.

CLASS 21. HAMBURG—Any other Variety. Cock.

1. Henry Pickles, Kayfield House, Earby (Silver-pencilled).
2. Henry Pickles, Kayfield House, Earby (Gold-spangled).
3. William Kerr, Bandeath, Stirling (Gold-pencilled).
V. William Cochrane, Moray Street, Blackford (Silver-spangled).
H. David K. Livingstone, Bridge of Earn (Gold-pencilled).
H. Weir Brothers, New Abbey Road, Dumfries (Silver-pencilled).

CLASS 22. HAMBURG—Any other Variety. Hen.

1. Henry Pickles, Kayfield House, Earby (Silver-spangled).
2. David K. Livingstone, Bridge of Earn (Gold-pencilled).
3. Henry Pickles, Kayfield House, Earby (Silver-spangled).
V. J. M. Campbell, Bonnykelly, New Pitsligo (Silver-spangled).
V. David K. Livingstone, Bridge of Earn (Gold-pencilled).
H. J. M. Campbell, Bonnykelly, New Pitsligo (Silver-spangled).

CLASS 23. HAMBURG—Any Variety. Cockerel.

1. Henry Pickles, Kayfield House, Earby (Black).
2. David Govan, 796 Great Eastern Road, Parkhead, Glasgow (Silver-spangled).
V. Henry Pickles, Kayfield House, Earby (Silver-spangled).
C. James Stewart, St Ottilia's Cottage, Jeanfield, Perth (Silver-spangled).

CLASS 24. HAMBURG—Any Variety. Pullet.

1. The Countess of Home, The Hirsel, Coldstream (Black).
2. David Govan, 796 Great Eastern Road, Parkhead, Glasgow (Silver-spangled).
V. David K. Livingstone, Bridge of Earn (Gold-pencilled).
H. Henry Pickles, Kayfield House, Earby (Silver-spangled).
H. Henry Pickles, Kayfield House, Earby (Black).

CLASS 25. PLYMOUTH ROCK. Cock.

1. William Kerr, Bandeath, Stirling.
2. George Duncan, Poultry Farm, Skene, Aberdeenshire.
3. William Watson, Craigton Farm, Clackmannan.
V. Duncan M'Millan, Old Smithy, Drymen.

CLASS 26. PLYMOUTH ROCK. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. Lady Gordon Cumming, Altyre House, Forres.
V. Peter Houston, 25 High Street, Dumbarton.

CLASS 27. PLYMOUTH ROCK. Cockerel.

1. Alexander M. Prain, Rawes, Longforgan.
2. Donald Urquhart, Knockomie, Forres.
3. Viscount Deerhurst, Dynes Hall, Halstead, Essex.
V. W. B. Dickinson, Longcroft, Lauder.

CLASS 28. PLYMOUTH ROCK. Pullet

1. Alexander M. Prain, Rawes, Longforgan.
2. W. B. Dickinson, Longcroft, Lauder.
3. Viscount Deerhurst, Dynes Hall, Halstead, Essex.

CLASS 29. MINORCA. Cock.

1. James Cook, Main Street, Muirkirk.
2. William J. H. Ritchie, Hawthorn Villa, Denny.
3. Andrew Pearson, Burnside, Elgin.
V. Robert Mitchell, Fowler Farm, Mauchline.

### CLASS 30. MINORCA. Hen.

1. James Cowan, West Port, Selkirk.
2. Alexander M. Prain, Rawes, Longforgan.
3. Lady Gordon Cumming, Altyre House, Forres.
V. James M'Leish, Bootmaker, Bankfoot.
V. Robert Paterson, Garrel Glen Cottage, Kilsyth.
V. R. D Pullar, Brahan, Perth.
H. James Douglas, 11 Loreburn Street, Dumfries.
C. James M'Leish, Bootmaker, Bankfoot.
C. James Waddell, Dunipace, Denny.

### CLASS 31. MINORCA. Cockerel.

1. Robert Mitchell, Fowler Farm, Mauchline.
2. Weir Brothers, New Abbey Road, Dumfries.
3. The Countess of Home, The Hirsel, Coldstream.
V. Andrew Pearson, Burnside, Elgin.
V. Alexander M. Prain, Rawes, Longforgan.

### CLASS 32. MINORCA. Pullet.

1. Alexander M. Prain, Rawes, Longforgan.
2. Weir Brothers, New Abbey Road, Dumfries.
3. Weir Brothers, New Abbey Road, Dumfries
V. The Earl of Rosebery, K.G , Dalmeny Park, Edinburgh.
H. Andrew Pearson, Burnside, Elgin.
H. Watters Brothers, Milnathort.
C. The Countess of Home, The Hirsel, Coldstream.
C. Donald M'Phail, Mount Pleasant, Liberton, Mid-Lothian.

### CLASS 33. LEGHORN—White. Cock.

1. Alexander M. Prain, Rawes, Longforgan.
2. John King, Rodenbain, Hollybush, Ayr.
3 Mrs John Gordon, Bogentary, Dunecht.
C. Thos. B. Kirkland, Corston, Coupar-Angus.

### CLASS 34. LEGHORN—White. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. Weir Brothers, New Abbey Road, Dumfries.
3. John King, Rodenbain, Hollybush, Ayr.
V. James Howieson, Firdale, Causewayend, Linlithgow.
V. James M'Leish, Bootmaker, Bankfoot.
H. John King, Rodenbain, Hollybush, Ayr.
C. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh.

### CLASS 35. LEGHORN—Any other Variety. Cock.

1. Alexander M. Prain, Rawes, Longforgan.
2. William Gemmell, Willowbank Cottage, Johnstone (Brown).
V. Andrew Pearson, Burnside, Elgin (Brown).
H. Weir Brothers, New Abbey Road, Dumfries (Brown).

### CLASS 36. LEGHORN—Any other Variety. Hen.

1. William Keys, Kintore, Aberdeenshire (Brown).
2. David Mealls, jun., Dunipace, Denny (Brown).
3. J. Clarkson, jun., The Green, Silsden, Keighley, Yorkshire (Brown).
V. Robert Durward, Shoemaker, Dunecht (Brown).
V. Andrew Pearson, Burnside, Elgin (Brown).

### CLASS 37. LEGHORN—Any Variety. Cockerel.

1. Weir Brothers, New Abbey Road, Dumfries (White).
2. Weir Brothers, New Abbey Road, Dumfries (White).
3. Alexander M. Prain, Rawes, Longforgan (White).

V. Andrew Donaldson, Clathick, Crieff (White).
V. Watters Brothers, Milnathort (Brown).
H. Andrew Pearson, Burnside, Elgin (Brown).

CLASS 38. LEGHORN. Any Variety. Pullet.

1. Alexander M. Prain, Rawes, Longforgan (White).
2. James Howieson, Firdale, Causewayend, Linlithgow (White).
3. Watters Brothers, Milnathort (Brown).
V. Robert Durward, Shoemaker, Dunecht (White).
H Andrew Pearson, Burnside, Elgin (Brown).
H. Weir Brothers, New Abbey Road, Dumfries (White)
C. Andrew Donaldson, Clathick, Crieff (White).
C. Mrs John Gordon, Bogentary, Dunecht (White).

CLASS 39. LANGSHAN. Cock.

1. J. & D. Alexander, Neatherbeath, Crossgates.
2. T. Haxton & Sons, Bankfold, Auchterarder.
3. Mrs Hart, Croft Terrace, Selkirk.
V. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
H. T. Haxton & Sons, Bankfold, Auchterarder.

CLASS 40. LANGSHAN. Hen.

1. T. Haxton & Sons, Bankfold, Auchterarder.
2. J. & D. Alexander, Neatherbeath, Crossgates.
V. T. Haxton & Sons, Bankfold, Auchterarder.
V. James Murray, 2 Moss Row, Fordel, Crossgates.

CLASS 41. ORPINGTON. Cock.

1. Baillie & Breingan, Beath Bleachfield, Cowdenbeath.
2. William Morgan, Balcurvie, Windygates, Fife.
3. The Earl of Rosebery, K G., Dalmeny Park, Edinburgh.
V. William Kerr, Bandeath, Stirling.
V. Alexander M. Prain, Rawes, Longforgan.
H. Peter Houston, 25 High Street, Dumbarton.
C. Colin E. Chisholm, Grange of Elcho, Perth.
C. Archibald Taylor, Edinburgh Cottage, Braeside, Liberton. Mid-Lothian.

CLASS 42. ORPINGTON. Hen.

1. Alexander M. Prain, Rawes, Longforgan.
2. William Morgan, Balcurvie, Windygates, Fife.
3. J. Clarkson, jun., The Green, Silsden, Keighley, Yorkshire.
V. Alexander Cowe, Square, Ellon.
V. Alexander Cowe, Square, Ellon.
V. Peter Houston, 25 High Street, Dumbarton.
V. Archibald Taylor, Edinburgh Cottage, Braeside, Liberton, Mid-Lothian.
H. J. P. Miller, 29 James Street, Perth.
C. Mrs Fitzgibbon, Dallas John, Forres.

CLASS 43. LANGSHAN or ORPINGTON. Cockerel.

1. The Countess of Home, The Hirsel, Coldstream (Buff Orpington).
2. Alexander Cowe, Square, Ellon (Black Orpington).
V. Archibald Taylor, Edinburgh Cottage, Braeside, Liberton, Mid-Lothian (Buff Orpington).
H. William Mackie, Woodburn, South Queensferry (Buff Orpington).

CLASS 44. LANGSHAN or ORPINGTON. Pullet.

1. Archibald Taylor, Edinburgh Cottage, Braeside, Liberton, Mid-Lothian (Buff Orpington).
2. Alexander Cowe, Square, Ellon (Buff Orpington).
3. William Mackie, Woodburn, South Queensferry (Buff Orpington).
V. A. Beardsley, Cardonald, Glasgow (Buff Orpington).
H. R. D. Pullar, Brahan, Perth (Buff Orpington).
C. The Countess of Home, The Hirsel, Coldstream (Buff Orpington).

CLASS 45. WYANDOTTE—Gold or Silver. Cock.

1. Henry Pickles, Kayfield House, Earby (Silver).
2. William Morgan, Balcurvie, Windygates, Fife (Gold).
3. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh (Silver).
V. Weir Brothers, New Abbey Road, Dumfries (Silver).
H. Thomas Middleton, Corntown, Conon Bridge (Silver).

CLASS 46. WYANDOTTE—Gold or Silver. Hen.

1. Henry Pickles, Kayfield House, Earby (Silver).
2. William Morgan, Balcurvie, Windygates, Fife (Silver).
V. Thomas Middleton, Corntown, Conon Bridge (Silver).

CLASS 47. WYANDOTTE—Any other Variety. Cock.

1. John Wharton, Honeycott Farm, Hawes, Yorkshire (Partridge).
2. Thomas Middleton, Corntown, Conon Bridge (White).

CLASS 48. WYANDOTTE—Any other Variety. Hen.

1. William Morgan, Balcurvie, Windygates, Fife (White).
2. Mrs A. Mansell, Crossrigg, Penrith (White).
V. John Wharton, Honeycott Farm, Hawes, Yorkshire (Partridge).

CLASS 49. WYANDOTTE—Any Variety. Cockerel.

1. Henry Pickles, Kayfield House, Earby (Silver).
2. John Wharton, Honeycott Farm, Hawes, Yorkshire (Partridge).
V. John Simpson, Bank Street, Buckie, Banffshire (Gold).
C. William Mackie, Woodburn, South Queensferry (Partridge).

CLASS 50. WYANDOTTE—Any Variety. Pullet.

1. Henry Pickles, Kayfield House, Earby (Silver).
2. John Simpson, Bank Street, Buckie, Banffshire (Gold).
3 The Countess of Home, The Hirsel, Coldstream (Silver).
V. William Mackie, Woodburn, South Queensferry (Partridge).
C. The Earl of Rosebery, K.G., Dalmeny Park, Edinburgh (Silver)

CLASS 51. GAME—Indian. Cock.

1. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
2. Dr John K. Goodall, Sutton Lodge, Brimington, Chesterfield.

CLASS 52. GAME—Indian. Hen.

1. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
2. Dr John K. Goodall, Sutton Lodge, Brimington, Chesterfield.
V. George Duncan, Poultry Farm, Skene, Aberdeenshire.

CLASS 53. GAME—Indian. Cockerel.

1 R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
2. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.

CLASS 54. GAME—Indian. Pullet.

1 R. S. Hunter, Fifeshire Poultry Farm, Ladybank.
2. R. S. Hunter, Fifeshire Poultry Farm, Ladybank.

CLASS 55. GAME—Old English. Cock.

1. John Hutt, Denend, Cardenden, Fife.
2. M'Lean & Sons, 20 Well Road, Lochgelly.
V. John Hutt, Denend, Cardenden, Fife.
H. Ernest Grant, Benholm, Forfar.
C. Ernest Grant, Benholm, Forfar.

CLASS 56. GAME—Old English. Hen.

1. Ernest Grant, Benholm, Forfar.
2. Ernest Grant, Benholm, Forfar.
V. John Hutt, Denend, Cardenden, Fife.
H. John Hutt, Denend, Cardenden, Fife.

CLASS 57. GAME—Modern. Cock.

1. Walter B. Longton, Walkinshaw, Renfrew (Black Red).
2. Alexander Shepherd, Lily Cottage, Forfar (Black Red).

CLASS 58. GAME—Modern. Hen.

1. Alexander Shepherd, Lily Cottage, Forfar (Black Red).
2. Frank Anderson, Town Head, Biggar.
H. Frank Anderson, Town Head, Biggar.

CLASS 59. GAME—Any Variety, not including Indian. Cockerel.

1. William Jamieson, 160 East High Street, Forfar (Duckwing).

CLASS 60. GAME—Any Variety, not including Indian. Pullet.

1. William Jamieson, 160 East High Street, Forfar (Duckwing).

CLASS 61. BANTAM—Game, any Variety, including Old English. Cock.

1. Adam & Saddler, Queen Street, Forfar (Duckwing).

CLASS 62. BANTAM—Game, any Variety, including Old English. Hen.

1. George Hamilton, Holehouse Farm, Neilston (Duckwing)

CLASS 63. BANTAM—Any other Variety. Cock.

1. Henry Pickles, Kayfield House, Earby (Black).
2. Lady Margaret Douglas Home, The Hirsel, Coldstream (Sebright).
V. John Williamson, Clark Terrace, Bellshill (Scotch Grey).
H. Robert Frew, The Barony, Cupar-Fife (Silver Sebright)
C. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr (Grey)

CLASS 64. BANTAM—Any other Variety. Hen.

1. Henry Pickles, Kayfield House, Earby (Black).
2. Robert Frew, The Barony, Cupar-Fife (Frizzle).
V. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr (Grey).
H. Lady Margaret Douglas Home, The Hirsel, Coldstream (Sebright).

CLASS 65. Any other recognised Breed of Poultry. Cock.

1. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
2. David Hastings, Glaister Cottage, Darvel, Ayrshire (Creve).
V. Peter Houston, 25 High Street, Dumbarton (Andalusian).
V. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).

CLASS 66. Any other recognised Breed of Poultry. Hen.

1. David Hastings, Glaister Cottage, Darvel, Ayrshire (Creve).
2. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr (Spanish).
3. Peter Houston, 25 High Street, Dumbarton (Andalusian).
V. F. Anderson, Bowershall, Dunfermline (Houdan, French).
V. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
V. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
H. Mrs Fitzgibbon, Dallas John, Forres (Andalusian).

CLASS 67. Any other recognised Breed of Poultry. Cockerel.

1. George Hamilton, Holehouse Farm, Neilston (Andalusian).
2. H. Wilkie, Coaltown, Markinch, Fife (Game Bantam).
V. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
V. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr (Grey Bantam).
H. Peter Houston, 25 High Street, Dumbarton (Andalusian).

CLASS 68. Any other recognised Breed of Poultry. Pullet.

1. Mrs D. Mackenzie, Maryfield, Meigle (Spanish).
2. H. Wilkie, Coaltown, Markinch, Fife (Game Bantam).
V. Peter Houston, 25 High Street, Dumbarton (Andalusian).

CLASS 69. TABLE FOWLS—Any Breed or Cross, to be judged solely as Table Fowls, and without regard to fancy points. Pair of Cockerels.

1. The Countess of Home, The Hirsel, Coldstream (Indian Game and Buff Orpington).
3. William Watson, Craigton Farm, Clackmannan (Buff Orpington and Dorking Cross).

CLASS 70. TABLE FOWLS—Any Breed or Cross, to be judged solely as Table Fowls, and without regard to fancy points. Pair of Pullets.

1. The Countess of Home, The Hirsel, Coldstream (Indian Game and Buff Orpington).
2. J. P. Strachan, Stoneywood, Aberdeenshire (Dorkings).
V. John Meikle, Auchincruive Estates Office, Mount-Hamilton, Ayr (Dorkings).

CLASS 71. DUCKS—Aylesbury. Drake.

1. The Countess of Home, The Hirsel, Coldstream.
2. The Countess of Home, The Hirsel, Coldstream.
V. W. B. Dickinson, Longcroft, Lauder.

CLASS 72. DUCKS—Aylesbury. Duck.

1. The Countess of Home, The Hirsel, Coldstream.
2. The Countess of Home, The Hirsel, Coldstream.

CLASS 73. DUCKS—Aylesbury. Drake (Young).

1. The Countess of Home, The Hirsel, Coldstream
2. The Countess of Home, The Hirsel, Coldstream.
H. W. B. Dickinson, Longcroft, Lauder.

CLASS 74. DUCKS—Aylesbury. Duck (Young).

1. The Countess of Home, The Hirsel, Coldstream.
2. W. B. Dickinson, Longcroft, Lauder.
V. The Countess of Home, The Hirsel, Coldstream.

CLASS 75. DUCKS—Rouen. Drake.

1. The Countess of Home, The Hirsel, Coldstream.
2. The Countess of Home, The Hirsel, Coldstream.
V. The Earl of Mansfield, Balboughty, Perth.

CLASS 76. DUCKS—Rouen. Duck.

1. The Countess of Home, The Hirsel, Coldstream.
2. The Countess of Home, The Hirsel, Coldstream.
H. The Earl of Mansfield, Balboughty, Perth.

CLASS 77. DUCKS—Any other Variety. Drake.

1. Mrs A. Mansell, Crossrigg, Penrith (Pekin).
2. S. Dalgleish, Blackburn, Chirnside, Berwickshire (Pekin).

CLASS 78. DUCKS—Any other Variety. Duck.

1. S. Dalgleish, Blackburn, Chirnside, Berwickshire (Pekin).
2. Mrs A. Mansell, Crossrigg, Penrith (Pekin).

CLASS 79. DUCKS—Any Breed (Aylesbury excepted). Drake (Young).

1. The Countess of Home, The Hirsel, Coldstream (Rouen).

CLASS 80. DUCKS—Any Breed (Aylesbury excepted). Duck (Young).

2. The Countess of Home, The Hirsel, Coldstream (Rouen).

CLASS 81. GEESE. Gander.

1. James Dow, Clathybeg, Auchterarder (Embden).
2. Alexander Shanks, Cuthelton Farm, Denny (Toulouse).
3. James Dow, Clathybeg, Auchterarder (Embden).
V. W. Woods, Auctioneer, Worksop, England (Toulouse).

CLASS 82. GEESE. Goose.

1. James Dow, Clathybeg, Auchterarder (Embden)
2. W. Woods, Auctioneer, Worksop, England (Toulouse).
3 John Page, Waterside, Callander (Embden).
V. Alexander Shanks, Cuthelton Farm, Denny (Toulouse).
H. James Dow, Clathybeg, Auchterarder (Embden).

CLASS 83. TURKEYS. Cock.

1. Miss Shanks, Cuthelton Farm, Denny (Bronze).
2. Miss Shanks, Cuthelton Farm, Denny (Bronze).
V. William J. M'Lagan, East Mid Lamberkin, Perth (American Bronze).

CLASS 84. TURKEYS. Hen.

1. W. Woods, Auctioneer, Worksop, England (American Bronze).
2. James Caldwell, Craighead, Girvan (Bronze).
V. Miss Shanks, Cuthelton Farm, Denny (Bronze).
C. William J. M'Lagan, East Mid Lamberkin, Perth (American Bronze).

## DAIRY PRODUCE

CLASS 1. POWDERED BUTTER, not less than 7 lb.—Premiums, £4, £2, and £1.

1. Andrew Fleming, Threepland, Eaglesham.
2. William Rennie, Parkhead, Slamannan.
3. Robert Gilmour, Stonebyres, Eaglesham.
V. James Mark, Hyndshaw Farm, Carluke.
H. William Paterson, Barnego, Denny.
C. Lilias Strang, Transy Farm, Dunfermline.

CLASS 2. FRESH BUTTER, Three 1 lb. Rolls.—Premiums, £4, £2, and £1.

1. Andrew Fleming, Threepland, Eaglesham.
2. R. G. Murray, Spittal, Biggar.
3. Robert Gilmour, Stonebyres, Eaglesham.
V. William Paterson, Barnego, Denny.
H. William Rennie, Parkhead, Slamannan.
C. Lilias Strang, Transy Farm, Dunfermline.

CLASS 3. CHEDDAR CHEESE, 56 lb. and upwards.—Premiums, £6, £4, £2, and £1.

1. A. W. Saunders, Dromore Farm, Kirkcudbright.
2. Weir Brothers, New Abbey Road, Dumfries.

3. Alexander Cross, of Knockdon, Maybole.
4. James Ferguson, Auchlane Dairy, Castle-Douglas.
V. J. C. Cunninghame, Dunragit Home Farm, Dunragit.
H. J. C. Cunninghame, Boreland Farm, Dunragit.
C. Robert Stevenson, Boghead, Galston.

CLASS 4. CHEESE, 14 lb. and under.—Premiums, £3, £2, and £1.

1. A. W. Saunders, Dromore Farm, Kirkcudbright.
2. Alexander Cross, of Knockdon, Maybole.
3. J. C. Cunninghame, Dunragit Home Farm, Dunragit.
V. J. C. Cunninghame, Boreland Farm, Dunragit.
H. James Ferguson, Auchlane Dairy, Castle-Douglas.
C. David Ferguson, Foxton, Cupar-Fife.

## IMPLEMENTS

Ivel Agricultural Motors, Limited.—For Ivel Agricultural Motor, Large Gold Medal.
John Scott, Edinburgh—For Scott Agricultural Motor, Large Gold Medal.
J. D. Allan & Sons, Murthly—For Drill Dung Spreader, Large Silver Medal.

## JUDGES

*Shorthorns.*—James Durno, Jackston, Rothienorman; James Peter, Berkeley Castle Estate Office, Berkeley.

*Aberdeen-Angus.*—Robert Bruce, Royal Dublin Society, Leinster House, Dublin; Robert Walker, Rosefield, Elgin.

*Galloway.*—John M'Turk, Rockville, Castle-Douglas; Andrew Montgomery, Nether Hall, Castle-Douglas.

*Highland.*—Duncan M'Diarmid, Camusericht, Rannoch Station; Archibald Turner, Kilchamaig, Whitehouse, Kintyre.

*Ayrshire.*—John Murray, jun., Carston, Ochiltree; James Wilson, Boghall, Houston.

*Fat Cattle and Fat Sheep.*—Thomas Roy, Craigclowan, Perth.

*Draught Stallions, Colts, and Geldings.*—James Gray, Birkenwood, Gargunnock; John Kerr, Redhall, Wigton, Cumberland.

*Draught Mares and Fillies.*—George A. Ferguson, Surradale, Elgin; James Sands, Greenfoot, Gargunnock.

*Hunters and Polo Ponies.*—William Taylor, Park Mains, Renfrew.

*Hackneys and Ordinary Ponies.*—F. W. Buttle, Kirkburn Manor, Driffield.

*Highland Ponies.*—J. Panton, M.R.C.V.S., Blair-Atholl.

*Shetland Ponies.*—Robert Brydon, The Dene, Seaham Harbour.

*Harness Classes.*—F. W. Buttle, Kirkburn Manor, Driffield; William Taylor, Park Mains, Renfrew.

*Blackfaced.*—Thomas T. Brydon, Burncastle, Lauder; John Stewart, Bochastle, Callander.

*Cheviot.*—John S. Paterson, Cummertrees, Annan; A. T. Elliot, Newhall, Galashiels.

*Border Leicester.*—William James Hume, Wormerlaw, Kelso; Andrew Smith, Longniddry.

*Half-Bred.*—John Riddell, West Peaston, Ormiston; William Tod, Stobshiel, Upper Keith.

*Shropshire.*—Alfred Mansell, College Hill, Shrewsbury.

*Oxford Down.*—A. F. Milton Druce, Queen Street, Oxford.

*Suffolk.*—Herbert E. Smith, The Grange, Walton, Ipswich.

*Swine.*—Robert Wallace, Auchenbrain, Mauchline.

*Poultry.*—A. K. Crichton, Estates Office, Bridge of Weir (classes 1 to 24 inclusive, 29 to 42 inclusive, and 65 to 68 inclusive); R. Stainthorp, Darlington (classes 25 to 28 inclusive, 43 to 64 inclusive, and 69 to 84 inclusive).

*Dairy Produce.*—Hugh Osborne, 45 Candleriggs Street, Glasgow.

## DISTRICT COMPETITIONS.

| | | | | | |
|---|---|---|---|---|---|
| 17 Districts— | Grants of £12 each (Section I.), less £6 not awarded | £198 | 0 | 0 |
| 14 " | Grants of £15 each (Section II.) | 210 | 0 | 0 |
| 10 " | Special Grants | 107 | 0 | 0 |
| 82 " | Medals for Shows | 52 | 5 | 6 |
| 29 " | Medals for Cottages and Gardens | 7 | 0 | 2 |
| 216 " | Medals for Ploughing, 1903-4 | 52 | 4 | 0 |
| 368 | | £626 | 9 | 8 |

## VETERINARY DEPARTMENT.

| | | | |
|---|---|---|---|
| 33 Silver Medals | £21 | 0 | 9 |

## ABSTRACT OF PREMIUMS.

| | | | |
|---|---|---|---|
| Perth Show | £2636 | 13 | 1 |
| District Competitions, 1904 | 626 | 9 | 8 |
| Veterinary Colleges | 21 | 0 | 9 |
| | £3284 | 3 | 6 |

# STATE OF THE FUNDS

OF

# THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

## As at 30th NOVEMBER 1904.

| | | |
|---|---|---|
| I. CONSOLS— | | |
| £4,000 2½ per cent Consols at 88⅜ . . . . . | | £3,535 0 0 |
| II. HERITABLE BONDS— | | |
| £11,000 at 3½ per cent, £21,000 at 3¼ per cent, £2,500 at 3 per cent . . . . . . . | | 34,500 0 0 |
| III. DEBENTURE AND PREFERENCE STOCKS— | | |
| £5,850 N.B. Railway Co. 3 per cent, at 93 . | £5,440 10 0 | |
| £2,727 Caled. Railway Co. 4 per cent, at 124 | 3,381 9 7 | |
| £2,347 London and North-Western Railway Company 3 per cent, at 97 . . | 2,276 11 9 | |
| £1,212 Mid Railway Co. 2½ per cent, at 79 . | 957 9 7 | |
| £2,400 Do. do. Preference Stock 2½ per cent, at 74 . . . . | 1,776 0 0 | |
| £2,036 N E Railway Co. 3 per cent, at 96 . | 1,954 11 2 | |
| £2,026 Gt. N. Railway Co. 3 per cent, at 95 . | 1,924 14 0 | |
| | | 17,711 6 1 |
| IV. BANK STOCKS*— | | |
| £6,407 7 8 Royal Bank of Scotland, at 251 | £16,082 10 7 | |
| £2,218 16 5 Bank of England, at 299½ . | 6,645 7 4 | |
| £2,500 0 0 British Linen Co. Bank, at 493 . | 12,325 0 0 | |
| £2,341 13 4 Bank of Scotland, at 356 . | 8,336 6 8 | |
| | | 43,389 4 7 |
| TOTAL AMOUNT OF INVESTED FUNDS . | | £99,135 10 8 |
| V. ESTIMATED VALUE of Buildings, No. 3 George IV. Bridge . . . . . . | £3,100 0 0 | |
| VI. ESTIMATED VALUE of Furniture, Paintings, Books, &c. . . . . . . | 1,000 0 0 | |
| | | 4,100 0 0 |
| VII. ARREARS OF SUBSCRIPTIONS considered recoverable . . | | 93 12 0 |
| VIII. BALANCE DUE BY ROYAL BANK OF SCOTLAND ON ACCOUNTS CURRENT at 30th November 1904 . . . . | | 1,809 19 10 |
| IX. CASH ON HAND at 30th November 1904 . . . | | 5 0 0 |
| AMOUNT OF GENERAL FUNDS | | £105,144 2 6 |
| X. TWEEDDALE MEDAL FUND— | | |
| Heritable Bond, at 3½ per cent . . . . . . | | £500 0 0 |
| XI. THE ROBERT MURDOCH PRIZE FUND— | | |
| Legacy by the late Miss Murdoch, Blantyre, to be applied in giving a prize of £10 a-year, while it lasts, to the Breeder of the best Clydesdale Brood Mare at the Annual Show of the Society, £100, less duty. | | |
| Amount per last account, including interest . . . . | | £47 7 1 |
| Interest on Deposit Receipt, dated 13th October 1903, and uplifted 20th October 1904 . . . . . . | | 0 19 1 |
| | | £48 6 2 |
| Transferred to Perth Show Account . . . . . | | 10 0 0 |
| On Deposit Receipt with Royal Bank, dated 20th October 1904 | | £38 6 2 |

* The original cost of these Bank Stocks was £23,632, 9s. 4d., showing a profit at present prices of £19,756, 15s. 3d

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILLESPIE, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 11*th January* 1905.

# VIEW OF RECEIPTS AND PAYMENTS

## For the Year 1903-1904.

### *RECEIPTS.*

| | | |
|---|---|---|
| 1. ANNUAL SUBSCRIPTIONS AND ARREARS received . . . | | £1,001 18 6 |
| 2. LIFE SUBSCRIPTIONS . . . . . . . . | | 822 18 0 |
| | | £1,824 16 6 |
| 3. INTERESTS AND DIVIDENDS— | | |
| Interests . . . . . . | £1,644 4 5 | |
| Dividends . . . . . | 1,715 17 3 | |
| | | 3,360 1 8 |
| 4. TRANSACTIONS . . . . . . . . | | 50 3 1 |
| 5. RECEIPT from Dumfries Show . . . . . | | 2 0 0 |
| 6. RECEIPTS from Perth Show . . . . . | | 8,909 18 8 |
| 7. INCOME-TAX repaid for year to 5th April 1904 . . . | | 186 19 4 |
| SUM OF RECEIPTS . . | | £14,333 19 3 |

### *PAYMENTS.*

| | | | |
|---|---|---|---|
| 1. ESTABLISHMENT EXPENSES— | | | |
| Salaries and Wages . . . . | | £1,472 0 0 | |
| Feu - duty, Taxes, Coal, Gas, Insurance, Repairs, and Furnishings . . . | | 279 5 8 | |
| | | £1,751 5 8 | |
| FEE TO AUDITOR of Accounts for 1902-1903 . | | 75 0 0 | |
| EDUCATION . . . . . . . | | 562 15 0 | |
| 4. CHEMICAL DEPARTMENT | | 276 8 4 | |
| 5. VETERINARY DEPARTMENT | | 21 0 9 | |
| 6. BOTANICAL DEPARTMENT | | 48 1 6 | |
| 7. DAIRY DEPARTMENT . | | 230 14 9 | |
| 8. SOCIETY'S TRANSACTIONS | | 838 1 2 | |
| 9. ORDINARY Printing, Advertising, Stationery, Postages, and Bank Charges. | | 289 2 3 | |
| 10. GRANTS to Public Societies | | 25 0 0 | |
| 11. THE LATE DR A. P. AITKEN'S MEMORIAL . | | 500 0 0 | |
| 12. EXPENSES in connection with new Royal Charter . | | 167 5 9 | |
| 13. EXPENSES in connection with Border Show . . | | 17 13 6 | |
| 14. MISCELLANEOUS PAYMENTS . . . . | | 136 4 6 | |
| 15. INVESTMENT made . . . | £1,766 2 0 | | |
| 16. PAYMENTS in connection with Dumfries Show . | | 181 0 0 | |
| 17. PAYMENTS in connection with Perth Show— | | | |
| Premiums . . . | £2,500 13 1 | | |
| General Expenses . . | 4,432 3 5 | | |
| | | 6,932 16 6 | |
| 18. PREMIUMS for Local Shows and District Competitions | | 637 9 3 | |
| SUM OF PAYMENTS . | | | 12,689 18 11 |
| BALANCE OF RECEIPTS . . | | | £1,644 0 4 |

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILLESPIE, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 11*th January* 1905.

## ABSTRACT of the ACCOUNTS of the HIGHLAND and

### CHARGE.

| | | | |
|---|---|---|---|
| 1. BALANCE due by Royal Bank of Scotland on Account Current at 30th November 1903 . . . . . . . | | | £1,937 1 6 |
| 2. ARREARS of Subscriptions outstanding at 30th Nov. 1903 . . . . . . . | | £113 6 0 | |
| Whereof due by Members who have compounded for life, and are thereby extinguished . | £6 3 6 | | |
| Sums ordered to be written off . | 50 1 0 | | |
| | | 56 4 6 | |
| | | | 57 1 6 |
| 3. INTERESTS AND DIVIDENDS— | | | |
| (1) Interests— | | | |
| On Heritable Bonds, less Income-tax . | | £1,085 9 5 | |
| On Debenture and Preference Stocks, do. . | | 540 2 10 | |
| On Deposit Receipt . . . . | | 18 12 2 | |
| | | £1,644 4 5 | |
| (2) Dividends— | | | |
| On Consols, less Income-tax . | £47 12 2 | | |
| On Bank Stocks . . | 1,668 5 1 | | |
| | | 1,715 17 3 | |
| | | | 3,360 1 8 |
| 4. SUBSCRIPTIONS— | | | |
| Annual Subscriptions . . . . . | | £1,085 0 6 | |
| Life Subscriptions . . . . . . | | 822 18 0 | |
| | | | 1,907 18 6 |
| 5. TRANSACTIONS—Sales and Advertisements . . . | | | 50 3 1 |
| 6. RECEIPT from Dumfries Show . . . . . | | | 2 0 0 |
| 7. RECEIPTS from Perth Show . . . . . . . | | | 8,909 18 8 |
| 8. INCOME-TAX repaid for year to 5th April 1904 . . . | | | 186 19 4 |
| SUM OF CHARGE . . | | | £16,411 4 3 |

## AGRICULTURAL SOCIETY of SCOTLAND for the Year 1903-1904.

### *DISCHARGE.*

| | | | |
|---|---|---|---|
| 1. Establishment Expenses— | | | |
| Salaries and Wages—Secretary, £900; Clerk, £300, Second Clerk, £200; Messenger, £72 | | | £1,472 0 0 |
| Feu-duty, £28; Taxes, £44, 19s. 2d.; Insurances, £17 | | | 89 19 2 |
| Coals and Gas | | | 25 10 6 |
| Repairs and Furnishings—Special, £124, 3s 5d.; Ordinary, £39, 12s 7d. | | | 163 16 0 |
| | | | £1,751 5 8 |
| 2. Fee to Auditor of Accounts for 1902-1903 | | | 75 0 0 |
| 3. Education— | | | |
| (1) Forestry—Vote to Lectureship in Edinburgh University | | £50 0 0 | |
| (2) Agriculture—Expenses of National Diploma Examination at Leeds | | 112 15 0 | |
| (3) Grant to Edinburgh and East of Scotland College of Agriculture—Building Fund | | 300 0 0 | |
| (4) Grant to Duchess of Sutherland's Technical School | | 100 0 0 | |
| | | | 562 15 0 |
| 4. Chemical Department— | | | |
| (1) Salaries to Dr A. P. Aitken, £25; and Mr J. Wyclif Black, £5, 5s | | £30 5 0 | |
| (2) Chemists' Fees and Expenses—Fees for Analyses to Members, £60, 15s; Analyses of Grain, &c., £26 | | 86 15 0 | |
| | | £117 0 0 | |
| (3) Expenses of Manuring and Sheep-Grazing Experiments, £278, 2s 4d—*Less* Grant from Board of Agriculture, £75, and proceeds of Sheep sold, £43, 14s | | 159 8 4 | |
| | | | 276 8 4 |
| 5. Veterinary Department—Medals | | | 21 0 9 |
| 6. Botanical and Entomological Department— | | | |
| Fee to Botanist for year | | £25 0 0 | |
| Testing Samples of Seeds for Members | | 12 0 0 | |
| Expenses of visiting Seed-Testing Station at Aynsome | | 11 1 6 | |
| | | | 48 1 6 |
| 7 Dairy Department— | | | |
| (1) Examination at Kilmarnock—Fees and Expenses | | £82 7 1 | |
| (2) Special Grants—Vote to Dairy School at Kilmarnock | | 100 0 0 | |
| | | £182 7 1 | |
| *Less* Fees forfeited by unsuccessful Candidates | | 4 0 0 | |
| | | £178 7 1 | |
| (3) Milk Record Scheme— | | | |
| Salaries and Expenses of Expert | £36 16 7 | | |
| Sundry Outlays | 35 6 4 | | |
| | £72 2 11 | | |
| *Less* Share of outlays received from Ayrshire | 19 15 3 | | |
| | | 52 7 8 | |
| | | | 230 14 9 |
| 8. Society's Transactions | | | 838 1 2 |
| 9 Ordinary Printing, £101, 19s 10d.; Advertising, £29, 15s. 6d; Stationery, Books, &c., £58, 0s 8d; Postages, &c., £90; Bank Charges, &c., £9, 6s. 3d. | | | 289 2 3 |
| 10. Grants to Public Societies—Scottish Meteorological Society, £20, Society for Prevention of Cruelty to Animals, £5 | | | 25 0 0 |
| 11. The Late Dr A P Aitken's Memorial | | | 500 0 0 |
| 12. Expenses in connection with new Royal Charter | | | 167 5 9 |
| 13. Expenses in connection with Border Show | | | 17 13 6 |
| 14. Miscellaneous Payments | | | 136 4 6 |
| 15. Investment made | | | 1,766 2 0 |
| 16. Payments in connection with Dumfries Show, 1903 | | | 181 0 0 |
| 17. Payments in connection with Perth Show, 1904—Premiums, £2500, 13s. 1d.; Expenses as per Show Account (page 7), £4432, 3s. 5d. | | | 6,932 16 6 |
| 18. Premiums for Local Shows and Competitions | | | 637 9 3 |
| 19. Arrears struck off as irrecoverable | | | 46 11 6 |
| 20. Arrears outstanding at 30th November 1904 | | | 93 12 0 |
| 21. Balances due by Royal Bank of Scotland on Account Current at 30th November 1904— | | | |
| Edinburgh Account | | £1,673 19 10 | |
| London Account | | 136 0 0 | |
| | | | 1,809 19 10 |
| 22. Cash on hand at 30th November 1904 | | | 5 0 0 |
| Sum of Discharge | | | £16,411 4 3 |

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILLESPIE, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

Edinburgh, 11*th January* 1905.

## ABSTRACT of the ACCOUNTS

### CHARGE.

| | | |
|---|---|---|
| **Local Subscriptions—** | | |
| Perthshire (Perth Show Division) Voluntary Assessment . | | £412 14 4 |
| Forfarshire (Western Division) " " . | | 282 19 7 |
| Fifeshire " " . | | 378 8 7 |
| Kinross-shire " " . | | 34 11 6 |
| William Maxwell of Donavourd—Donation . . . | | 10 0 0 |
| | | £1,118 14 0 |
| 2. **Amount Collected during Show—** | | |
| Drawn at Gates . . . . . | £4,027 15 7 | |
| Drawn at Grand Stand . . . . | 643 19 10 | |
| Catalogues and Awards sold . . . | 316 4 9 | |
| Cloak-Rooms . . . . . . | 4 17 0 | |
| | | 4,992 17 2 |
| 3. **Forage Sold** . . . . . . . . | | 12 3 2 |
| 4. **Rent of Stalls** . . . . . . . . | | 2,199 18 0 |
| 5. **Rent of Refreshment Booths** . . . . . | | 250 0 0 |
| 6. **Advertisements in Catalogue and Premium List** . | | 111 4 6 |
| 7. **Special Prizes Contributed** . . . . . . | | 190 10 0 |
| 8. **Income from Tweeddale Medal Fund** . . . . | | 15 9 4 |
| 9. **Collected at Gates at Trials of Implements** . . | | 2 18 0 |
| 10. **Interest from Royal Bank** . . . . | | 16 4 6 |
| | | £8,909 18 8 |

| | | |
|---|---|---|
| *Note.*—From the above balance of . . . . | | £1977 2 2 |
| There falls to be deducted— | | |
| (1) Premiums undrawn at 30th November 1904, amounting to . . . . . | £136 0 0 | |
| (2) One-eighth of £100, cost of new Turnstiles, 1903 . . . | 12 10 0 | |
| | | 148 10 0 |
| Making the probable Surplus . . | | £1828 12 2 |

## of the PERTH SHOW, 1904.

### DISCHARGE.

| | | | |
|---|---|---|---|
| 1. | SHOWYARD EXPENDITURE— | | |
| | Fitting up Showyard | | £2,690 3 4 |
| | Rosettes, £21, 7s. 2d.; Canvas, £12, 6s. | | 33 13 2 |
| | Miscellaneous | | 9 5 10 |
| | | | £2,733 2 4 |
| 2. | FORAGE | | 306 8 0 |
| 3. | POLICE | | 50 3 6 |
| 4. | TRAVELLING EXPENSES of Judges, Stewards, &c. | | 114 19 7 |
| 5. | HOTEL AND LUNCHEONS— | | |
| | Hotel Bill for 29 Directors, 7 Stewards, 31 Judges, &c. | £144 10 6 | |
| | Luncheons and Breakfasts in Showyard for Directors, Judges, and Committee | 181 19 3 | |
| | | | 326 9 9 |
| 6. | MUSIC | | 130 0 7 |
| 7. | PRINTING | | 262 8 7 |
| 8. | ADVERTISING and Bill-posting | | 143 5 8 |
| 9. | HIGHLAND INDUSTRIES | | 7 0 0 |
| 10. | VETERINARY INSPECTION | | 12 0 0 |
| 11. | CONCERT for Attendants | | 0 15 0 |
| 12. | TREASURER | | 25 0 0 |
| 13. | ASSISTANTS and Attendants | | 174 10 1 |
| 14. | POSTAGES | | 50 10 0 |
| 15. | FORESTRY EXHIBITION (Prizes awarded) | | 20 0 0 |
| 16. | IMPLEMENT TRIALS | | 61 5 8 |
| 17. | MISCELLANEOUS | | 14 4 8 |
| | | | £4,432 3 5 |
| 18. | PREMIUMS drawn at 30th November 1904 | | 2,500 13 1 |
| | | | £6,932 16 6 |
| | BALANCE OF RECEIPTS | | 1,977 2 2 |
| | | | £8,909 18 8 |

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILLESPIE, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 11*th January* 1905.

## ABSTRACT of the ACCOUNTS of the

### *CHARGE.*

I. FUNDS as at 30th November 1903—

| | | | | | | |
|---|---|---|---|---|---|---|
| £3,193, 6s. 8d. 3 per cent Debenture Stock of the North British Railway Company, purchased at . . . . . | | | | £2,650 | 0 | 0 |
| Amount on Loan over the Earl of Minto's Estates, at 3½ per cent | | | | 3,500 | 0 | 0 |
| £550 Lancashire and Yorkshire Railway Company 3 per cent Debenture Stock, purchased at . . . . . | | | | 611 | 10 | 6 |
| £190 London and North-Western Railway Company 4 per cent Debenture Stock, purchased at . . . . . | | | | 259 | 1 | 11 |
| | | | | £7,020 | 12 | 5 |
| BALANCE in Royal Bank on Account Current . . . . | | | | 271 | 19 | 10 |
| | | | | £7,292 | 12 | 3 |
| II. INTEREST— | | | | | | |
| On Investments— | | | | | | |
| On £3,193, 6s. 8d. North British Railway Company 3 per cent Debenture Stock, £95, 16s., less tax £4, 12s. 8d. . | £91 | 3 | 4 | | | |
| On £3,500 on Loan over the Earl of Minto's Estates at 3¼ per cent, £113, 15s , less tax £5, 10s. . . . . . | 108 | 5 | 0 | | | |
| On £550 Lancashire and Yorkshire Railway Company 3 per cent Debenture Stock, £16, 10s , less tax 15s. 6d. . . . | 15 | 14 | 6 | | | |
| On £190 London and North-Western Railway Company 4 per cent Guaranteed Stock, £7, 12s , less tax 7s. 2d. . | 7 | 4 | 10 | | | |
| | | | | 222 | 7 | 8 |
| SUM OF CHARGE . . . | | | | £7,514 | 19 | 11 |

## ARGYLL NAVAL FUND for Year 1903-1904.

### *DISCHARGE.*

I. ALLOWANCES to the five following Recipients—

| | | | |
|---|---|---|---|
| John S. Gordon Fraser (sixth year) . . . . | | | £40 0 0 |
| Evan Campbell Bunbury (third year) . . . . | | | 40 0 0 |
| Gordon Campbell (second year) . . . . | | | 40 0 0 |
| Donald P. C. Campbell (second year) . . . . | | | 40 0 0 |
| John S. Binny Scott (first year) . . . . . | | | 40 0 0 |
| | | | £200 0 0 |

II. FUNDS at 30th November 1904—

| | | |
|---|---|---|
| £3,193, 6s. 8d. 3 per cent Debenture Stock of the North British Railway Company, purchased at . . . . . . | £2,650 0 0 | |
| Amount on Loan over the Earl of Minto's Estates, at 3½ per cent . . . . . . | 3,500 0 0 | |
| £550 Lancashire and Yorkshire Railway Company 3 per cent Debenture Stock, purchased at . . . . . . . . | 611 10 6 | |
| £190 London and North-Western Railway Company 4 per cent Debenture Stock, purchased at . . . . . . . . | 259 1 11 | |
| | £7,020 12 5 | |
| Balance in Royal Bank on Account Current . | 294 7 6 | |
| | | 7,314 19 11 |

SUM OF DISCHARGE . . £7,514 19 11

JAS. H. GIBSON-CRAIG, *Treasurer.*
JOHN GILLESPIE, *Member of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, 11*th January* 1905.

# PROCEEDINGS AT BOARD MEETINGS.

## MEETING OF DIRECTORS, 3RD FEBRUARY 1904.

*Present.*—*Vice-President*—Mr John Speir, Newton Farm. *Ordinary Directors*—Mr David Wilson of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr John Wilson, Chapelhill; Mr St Clair Cunningham, Hedderwick Hill; Mr Alexander Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr E. Douglas Paton, Broomhill; Mr Alexander M. Gordon of Newton; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Sir Archd. Buchan Hepburn of Smeaton, Bart.; the Right Rev. John Gillespie, LL.D., Mouswald Manse, Mr Jonathan Middleton, Clay of Allan; Mr C. H. Scott Plummer of Sunderland Hall. *Extraordinary Directors*—Mr Alexander Macduff of Bonhard, Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Honorary Secretary*—Sir John Gilmour of Montrave, Bart. *Auditor*—Mr Wm. Home Cook, C.A. In the absence of the Earl of Mansfield, Mr Gordon took the chair.

### *New Charter.*

Dr GILLESPIE, in reference to the new charter, pointed out the necessity for the formation of a committee to consider what steps should be taken to bring this new charter into operation. He moved that this committee be composed of Lord Mansfield, Sir James H. Gibson-Craig, Sir John Gilmour, Sir Ralph Anstruther, Dr Wilson, Mr A. M. Gordon, Mr Mark, and himself.

Mr JOHN SPEIR seconded, and the motion was agreed to.

There was laid on the table a letter from Mr Gavin Ralston, giving notice of motions at next general meeting, to the effect that the Directors be instructed to take no action under the new charter so far as it dealt with education, and that a committee be appointed to go into the whole circumstances leading up to the application by the Society to the Privy Council for such charter.

### *Perth Show*, 1904.

The SECRETARY intimated Lord Mansfield's offer to present President's champion medals for the best animals in the stock classes, on the same lines as in former years.

A letter was read from Perth Agricultural Society asking the Board to reconsider their decision anent the doing away with classes for fat sheep at the Perth Show.

Sir ROBERT MONCREIFFE moved the suspension of the standing orders so that the question might be considered. This was seconded. Dr Wilson, Carbeth, moved the previous question. Fourteen voted for the amendment, and four for the motion.

Mr Clark, Coupar-Angus, was appointed to act as Veterinary Inspector.

The minutes of meeting of a Committee on same date to consider the Motor and Implement Trials were submitted. The following recommendations were made: (1) That a public trial of agricultural motors be held in the Perth Show district this year; (2) that it be remitted to a committee with powers to carry out this trial; (3) that the committee have powers to award one or two gold or silver medals for machines of merit.

Mr W. S. FERGUSON, Pictstonhill, speaking with reference to the classes for fat

cross sheep at Perth Show, 1904, intimated that he was willing to provide the prize money—£10—for two such classes, and would be obliged if the Board would accept same.

The offer was accepted with thanks.

The Secretary was instructed to make the necessary arrangements for ambulance service in the Showyard.

*Argyll Naval Fund.*

Mr JOHN STEWART BINNY SCOTT, son of the late Captain Scott, R.N., was elected to the vacancy in the list of beneficiaries caused by the gazetting of Mr James Douglas Campbell.

*Science Committee.*

It was resolved that the schedules of unit values of manures and feeding stuffs as revised by the Science Committee be circulated as usual.

## MEETING OF DIRECTORS, 2ND MARCH 1904.

*Present.—Vice-President*—Mr John Speir, Newton Farm. *Ordinary Directors*—Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth, Mr John M'Hutchen Dobbie, Campend; Mr John Wilson, Chapelhill, Edinburgh; Mr St Clair Cunningham, Hedderwick Hill; Mr Alex. Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr J. Ernest Kerr, Harviestoun Castle; Mr E. Douglas Paton, Broomhill; Sir Archibald Buchan Hepburn of Smeaton, Bart.; the Right Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan. *Extraordinary Directors*—Mr Alexander Macduff of Bonhard; Mr W. T. Malcolm, Dunmore Home Farm; Mr W. S. Ferguson, Pictstonhill; Mr R Shirra Gibb, Boon. *Honorary Secretary*—Sir John Gilmour of Montrave, Bart. The Earl of Mansfield in the chair.

The CHAIRMAN feelingly referred to the loss which the Society and agriculture had sustained through the lamented death of the Earl of Strathmore.

*Perth Show*, 1904.

The minutes of a meeting of Stewards held that day were agreed to. The arrangements for parades, &c., will be the same as at recent Shows.

It was agreed to give the Society's patronage to a ball to be held in Perth on the Show week.

Minutes of meeting of the Committee on Implement Trials held the same day were submitted. In connection with the implement trials the Board had tried to get two members of the Scottish Agricultural Engineering Association to act along with their own Committee in judging these trials. It had not been possible, however, for the engineering society to get two members of the body who were not personally interested in the sale of one or other of the implements in these trials. They therefore requested that such trials should be controlled entirely by the members of the Board, suggesting, however, that what they called standard machines should not be submitted to new trials. After discussion, the Committee recommended that the trials of potato-diggers, potato-dressers, and turnip-lifters, which it was proposed to hold this year, be postponed till next year, it being clearly understood that the machines competing then would either be new machines or old ones with radical improvements. The premiums to be offered would be £50 for potato-raisers, £20 for turnip-lifters, and £10 for potato-dressers. Further details were remitted to the Committee, and the minutes were agreed to.

*Breach of Showyard Regulations.*

The SECRETARY submitted the report of the Committee and Conference on breaches of Show Regulations. He said doubt had been expressed on the question whether it was intended that all the recommendations should be retrospective. The first clause mentioned that it would only refer to incidents which occurred after the 1st of January 1904. It was intended that that should apply to all the regulations.

*Forestry.*

A letter was read from the Royal Scottish Arboricultural Society asking support to the following resolution adopted by that Society on 16th February: "That it is the

opinion of the members of the Royal Scottish Arboricultural Society, assembled in annual meeting, that the Board of Agriculture should now take steps to give effect to the recommendations of the Departmental Committee on Forestry, as far as regards Scotland, by providing an estate to serve as a state forest demonstration area, and also by providing example plots in connection with Edinburgh University; and further, that forestry education in this country will not be adequately provided for until the foregoing are supplied, and a thoroughly equipped forest school is established in Scotland."

It was agreed to support this resolution.

*Bracken Trials.*

The minutes of a meeting of Committee on this subject, held on 3rd February, were submitted. The Committee found that none of the appliances entered were capable of destroying brackens on rough, stony, or rocky ground, and it was therefore proposed that the trials be abandoned. This was agreed to.

*Preservatives in Milk.*

Dr GILLESPIE moved: "That it be submitted to the Science Committee to consider and report as to the desirability of steps being taken to prohibit the use of preservatives in milk and its products."

Mr JOHN SPEIR, Newton, seconded, and the matter was remitted to the General Committee with powers.

*New Charter.*

It was resolved that a special general meeting of the members of the Society be convened, to be held in the Synod Hall, Castle Terrace, Edinburgh, on Wednesday, 6th April, at 2.15 P.M., to consider the question of the conducting the Society's educational work under the new Royal Charter.

## MEETING OF DIRECTORS, 6TH APRIL 1904.

*Present.—President*—The Earl of Mansfield. *Vice-President*—Mr John Speir, Newton Farm. *Ordinary Directors*—Mr Wm. Taylor, Park Mains; Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth, D.Sc.; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr John Wilson, Edinburgh; Mr St Clair Cunningham, Hedderwick Hill, Mr Robert F. Dudgeon of Cargen; Mr Alex Cross of Knockdon, Mr A. H. Anderson, Kippendavie Estate Office; Mr John M'Caig, Challoch, Mr Wm. Duthie, Tarves; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr Wm. Clark, Netherlea; Mr J. Ernest Kerr, Harviestoun Castle; Mr E. Douglas Paton, Broomhill; Mr Alex. M. Gordon of Newton, Mr R. Sinclair Scott, Burnside; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archd. Buchan Hepburn of Smeaton, Bart.; Mr John Marr, Cairnbrogie; the Right Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan. *Extraordinary Directors*—Sir Ralph Anstruther of Balcaskie, Bart., Sir Charles E. Adam of Blair-Adam, Bart.; Mr Alex. Macduff of Bonhard; Mr George Dun, Woodmill; Mr Charles Howatson of Glenbuck; Mr W. T. Malcolm, Dunmore Home Farm; Captain Clayhills Henderson of Invergowrie, R.N.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr John M. Martin, Mid-Calder; Mr C. M. Cameron, Balnakyle; Mr Robert Paterson, Hill of Drip; Mr John Ballingall, Dunbog. *Honorary Secretary*—Sir John Gilmour of Montrave, Bart. *Auditor*—Mr Wm. Home Cook, C.A. The Earl of Mansfield in the chair.

The CHAIRMAN referred in sympathetic terms to the death of Mr Walter Elliot, Hollybush, Galashiels, who had long been a Director of the Society, and for many years Steward of the Sheep department at the Show.

*Glasgow Show, 1905.*

Mr R. SINCLAIR SCOTT moved that the Show of 1905 be held in Glasgow from Tuesday 11th to Friday 14th July, inclusive. Mr Scott explained that there had been some difficulty in fixing the date, but having regard to railway facilities and other circumstances, the dates named had been found to be most suitable.

This was agreed to.

*Registration of Sheep.*

On the motion of Mr W. S. FERGUSON, seconded by Mr CHARLES HOWATSON, it was agreed that it was premature to restrict competition in the sheep classes at the Show to animals entered in the breed registers.

*Antiseptics in Dairy Produce.*

The minutes of the Science Committee bore that the Committee had considered the remit regarding the use of antiseptics in milk and its products, and had agreed to petition against such use. In the interests of public health, and in justice to the dairy interests, steps should be taken at once for the total prohibition of the use of antiseptics in milk and its products.

This was agreed to.

*Education Bill.*

On the motion of Dr GILLESPIE, the following Committee was appointed to consider the Education (Scotland) Bill, 1904, and report: Dr Gillespie, Mr David Wilson, Messrs Alexander Cross, John Speir, John M. Martin, J. M'Hutchen Dobbie, Sir Ralph Anstruther, Bart., and Dr Shirra Gibb, with the Secretary.

*Circular by Professor Wallace.*

The SECRETARY called the attention of the Board to accusations against his conduct as Secretary of the Society, which are made in a printed letter by Professor Wallace dated 2nd inst., and circulated amongst the members of the Society. He respectfully asked the Board to have these allegations investigated, so that the members of the Society may be made aware of the facts.

The Board agreed to the request, and the following Committee was appointed to investigate the matter and report—viz., Sir James Gibson-Craig, Mr Cross, Dr Wilson, Mr Ferguson, Dr Gillespie, Dr Shirra Gibb, Mr Gordon, Mr Middleton, and the Chairman of the Board.

At this stage the meeting adjourned, to resume its sitting at the close of the special general meeting to be held later in the day.

*Adjourned Meeting.*

The Board resumed its sitting at the close of the special general meeting in the Synod Hall, the Earl of Mansfield presiding.

The resolutions adopted at the special general meeting were submitted.

Instructions were given to the Secretary to make the necessary arrangements for carrying through the examination for the National Diploma in Agriculture at Leeds on the 9th May next and following days.

## MEETING OF DIRECTORS, 4TH MAY 1904.

*Present.—Vice-President*—Mr John Speir, Newton Farm. *Ordinary Directors*—Mr William Taylor, Park Mains; Mr David Wilson, D.Sc., of Carbeth; Mr John M'Hutchen Dobbie, Campend; Mr Thomas Gordon Duff of Drummuir; Mr John Wilson (Chapelhill), Edinburgh; Mr Alex. Cross of Knockdon; Mr A. H. Anderson, Kippendavie; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr E. Douglas Paton, Broomhill; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Sir Archd. Buchan Hepburn of Smeaton, Bart.; the Right Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan. *Extraordinary Directors*—Sir Charles E. Adam of Blair-Adam, Bart.; Mr Alexander Macduff of Bonhard; Mr George Dun, Woodmill; Mr Charles Howatson of Glenbuck; Mr W. T. Malcolm, Dunmore Home Farm; Captain Clayhills Henderson of Invergowrie, R.N.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr John M. Martin, Murieston House; Mr John Ballingall, Dunbog. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Hon. Secretary*—Sir John Gilmour of Montrave, Bart. *Auditor*—Mr William Home Cook, C.A. In the absence of the Earl of Mansfield, Sir John Gilmour took the chair.

*The late Dr Aitken.*

Before proceeding with the usual business, the CHAIRMAN made feeling reference to the loss sustained by the Society in the death of Dr Aitken, late chemist to the

Society. It was agreed to record an expression of regret in the Society's minutes, and the Secretary was instructed to send a letter of condolence to Mrs Aitken and family.

*Perth Show*, 1904.

The SECRETARY intimated a donation of £10 by Mr W. Maxwell of Donavourd to the general funds.

Attending Members for the various classes were appointed.

*Border Show of* 1906.

A Committee, consisting of Mr M'Hutchen Dobbie, Dr Gillespie, Mr Taylor, Mr Ferguson, and Mr Christie, was appointed to consider and report as to the centre at which this Show is to be held.

*Education (Scotland) Bill.*

The Special Committee on the Scotch Education Bill recommended that (1) the Directors approve generally of the Bill; (2) that, while welcoming the enlargement of the School Board area indicated in the Bill, the Directors are strongly of opinion that, save in the cases of some exceptionally situated counties, the county would be preferable to the district as the area; and (3) that the Directors approve of the provisions for the better administration of the various funds available for secondary and technical education, and for the locating of a Representative of the Scottish Education Department in Scotland, copies of these resolutions to be sent to the Secretary for Scotland, the Scotch Education Department, and to Scottish members of Parliament.

The recommendations were unanimously adopted.

*Adulteration of Malt Whisky with Raw Grain Whisky.*

A Committee appointed to consider this subject recommended that the Society support the Bill brought into Parliament for the purpose of preventing whisky which is not pure malt whisky being sold as malt whisky.

This was agreed to.

*Tuberculosis (Animal) Compensation Bill.*

With reference to this Bill the following resolution was adopted:—"Approve of compensation being paid for animals condemned in the interest of public health, but believe that this can be done equitably only if the compensation is paid largely from imperial sources."

*Weights and Measures (Metric System) Bill.*

In compliance with a request by Lord Belhaven that the Society send a witness to give evidence before the Select Committee of the House upon this Bill, Mr John Speir, Newton, was appointed, subject to a convenient date being arranged.

*Publications.*

The minutes of the Publications Committee, which met on same date, were submitted. The Committee approved of payments for articles in the recently issued volume of the 'Transactions,' to the amount of £169, also that a reprint of the report on the milk records scheme be made available for circulation at 6d. per copy.

The minutes were approved of.

*National Diploma and Forestry Education.*

A Committee was appointed to draft new bye-laws necessary under the new charter, this draft to be submitted to a future meeting of the Board.

The Secretary was given authority to see the dairy examinations carried through under existing regulations.

## MEETING OF DIRECTORS, 1ST JUNE 1904.

*Present.—Ordinary Directors*—Mr F. W. Christie, Dairsie Mains; Mr David Wilson of Carbeth, D.Sc., Mr John M'Hutchen Dobbie, Campend; Mr John Wilson, Chapelhill, Edinburgh; Mr St Clair Cunningham, Hedderwick Hill; Mr Alex. Cross of Knockdon, Mr A. H. Anderson, Kippendavie Estate Office; Mr

John Cran, Kirkton; Mr Jas. Stenhouse, Turnhouse; Mr Wm. Clark, Netherlea; Mr J. Ernest Kerr, Harviestoun Castle; Mr E. Douglas Paton, Broomhill; Mr Alex. M. Gordon of Newton; Mr John Murray, Munnieston: the Right Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan. *Extraordinary Directors*—Sir Charles E. Adam of Blair-Adam, Bart.; Mr Alex. Macduff of Bonhard; Mr W. T. Malcolm, Dunmore Home Farm; Capt. Clayhills Henderson of Invergowrie, R.N.; Mr W. S. Ferguson, Pictstonhill; Mr R. Shirra Gibb, Boon; Mr John M. Martin, Murieston House; Mr Robert Paterson, Hill of Drip. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. The Earl of Mansfield in the chair.

A letter was read from Mrs Aitken, acknowledging receipt of the letter of condolence in connection with the death of her husband, the late Dr A. P. Aitken.

### *Perth Show*, 1904.

The Committee having charge of motor trials at Perth reported that they had entries of two agricultural motors, one from Mr John Scott, Edinburgh, and the other from the Ivel Company, in connection therewith. The Committee proposed to have trials of other implements in connection with the Show, in particular of Allan's farmyard dung-spreader.

### *Glasgow Show*, 1905.

*Date.*—A letter was read from the Scottish railway companies suggesting that it would be necessary to hold this Show in the first week in July, so as to avoid conflict with the traffic in connection with the Glasgow Fair holidays. After some discussion, it was agreed that the Glasgow Show of 1905 should open on Tuesday 4th July

*Local Fund.*—On receipt of a letter from the county clerk of Argyllshire, intimating the refusal of the County Council to raise a voluntary assessment,

Dr GILLESPIE referred to what was understood to be the reason on the part of the Argyllshire County Council There appeared to be an impression that there had been a lack of courtesy towards representations from Argyllshire. The doctor had no recollections of that kind, but he was sure that if any such could be brought to their remembrance the Board would be only too pleased to make reparation. He hoped the County Council would reconsider its position. The Society gave strong support to the Blackface breed of sheep and to Highland cattle, and they also were very liberal in giving votes to local shows, of which Argyllshire had a full share.

Other members of the Board joined in the representation.

### *Border Show of* 1906.

The SECRETARY reported that he had received several letters from Mr Ramsay Smith on behalf of the County Council of Peeblesshire, and also from Mr Dyson and others, urging that the Show of 1906 be held at the town of Peebles Mr Dyson, writing as secretary of the West Linton Agricultural Society, promised on behalf of the society a grant of £100, and also intimated that local committees had been formed for the purpose of collecting funds, on condition that the Show of 1906 be held at Peebles. A letter was also read from Provost Turnbull, Melrose, urging the claims of that town. These communications were remitted to the Committee appointed for that Show.

### *Maggots in Sheep.*

The Committee on Maggots in Sheep reported that they had held a consultation with Dr Stewart MacDougall regarding this question, and had advanced matters as far as practicable. The Committee was continued to make further inquiry and investigation.

### *N.D.A.*

Dr GILLESPIE formally reported regarding the National Diploma examinations held at Leeds, the results of which have already been published.

### *Office-Bearers' Committee.*

It was agreed, on the motion of Sir JAMES H. GIBSON-CRAIG, "That the Office-Bearers' Committee be appointed at the November meeting of Directors."

### *Professor Wallace's Circular.*

The report of Committee appointed at the meeting of the Board of Directors of April 6th was read. (The report is printed in the proceedings of the general meeting held on 1st June 1904.)

A letter from Professor Wallace, of date 16th May 1904, was read.

The following resolution was unanimously adopted: "The Board of Directors approve of and adopt the report, and desire to express regret that a man in the position of the Professor of Agriculture in the University of Edinburgh should have written and published a letter of the nature of that which has caused this investigation."

## MEETING OF DIRECTORS, 2ND NOVEMBER 1904.

*Present.—Vice-President*—Mr Charles Howatson of Glenbuck. *Ordinary Directors*—Mr St Clair Cunningham, Hedderwick Hill; Mr Alexander Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; Mr John M'Caig, Challoch; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr Wm. Clark, Netherlea; Mr Andrew Hutcheson, Beechwood; Mr E. Douglas Paton, Broomhill; Mr R. Sinclair Scott, Burnside; Mr John Murray, Munnieston; the Very Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan; Mr C. H. Scott Plummer of Sunderland Hall; Mr John M'Hutchen Dobbie, Campend; Mr Wm. Taylor, Park Mains; Mr W. S. Ferguson, Pictstonhill; Mr David Wilson, D.Sc., of Carbeth; Mr Thomas Gordon Duff of Drummuir; Mr H. M. Leadbetter, Legerwood. *Extraordinary Directors*—Mr John Speir, Newton Farm; Mr Walter Elliot, Ardtornish; Mr R. Shirra Gibb, Boon; Mr John M. Martin, Mid-Calder; Mr C. M. Cameron, Balnakyle; Mr John Ballingall, Dunbog; Mr F. W. Christie, Dairsie Mains; Mr John Wilson, Chapelhill, Mr John M. Aitken, Norwood; Mr James I. Davidson, Saughton Mains. In the absence of the Earl of Mansfield, the Very Rev. Dr Gillespie took the chair

### *Appointment of Chairman.*

The CHAIRMAN moved that the Earl of Mansfield be re-elected Chairman of the Board for the ensuing season. They were extremely fortunate in having for their chairman a nobleman such as Lord Mansfield, who had the interests of the Society so deeply at heart.

The motion was adopted with great cordiality.

### *Standing Committees.*

The CHAIRMAN said the only change in the standing committees was the retiral of Sir James H. Gibson-Craig, Bart, as convener of the General Show Committee. They were all aware how long Sir James had filled the position, and he moved that they accept his resignation with regret, and record in their minutes their warm appreciation of the lengthened and very valuable services rendered by him.

This was approved unanimously.

A committee was appointed to prepare the list of office-bearers and directors for 1905-6.

### *Perth Show, 1904.*

The SECRETARY submitted the accounts for the Perth Show, which showed a credit balance of £1830.

The list of awards was laid on the table.

*Transfer of Tickets.*—It was intimated that one or two cases of the transference of tickets had taken place, but that satisfactory explanations and apologies had been offered.

*Trials of Agricultural Motors and Manure Distributors.*—The Committee appointed to look after these matters met on the same day to adjust the report of the trials, which will be immediately issued to the public. In virtue of the power given them, the Committee had awarded the Society's Gold Medal to the owners of the Scott and the Ivel motors. The Committee recommended that the Society's Silver Medal be awarded to Messrs J. D. Allan & Sons, Murthly, for their drill dung-spreader, which had worked very satisfactorily. The Convener of the Committee moved approval of the report of the Committee, and this was agreed to.

A hearty vote of thanks was accorded to Mr Ferguson, Pictstonhill, for the excellent facilities he had given for the implement trials.

### *Tea Pavilion.*

Intimation was made of a donation of £50 to the funds of the Royal Scottish Agricultural Benevolent Institution from the proceeds of the Temperance Refreshment Booth in the Showyard.

*Glasgow Show*, 1905.

A letter was read from Mr Lindsay, clerk to the Police Department of the Corporation of Glasgow, granting, for use as an extension to the Showyard, a strip of ground belonging to the Corporation, lying between the Show-ground and the North British Railway. The Chairman expressed their indebtedness to the Corporation of Glasgow for their aid in this connection.

Various special prizes were accepted with votes of thanks.

*Show of* 1906.

The Board had sat in private earlier in the day to consider where the Border Show of 1906 should be held, it being decided by a majority that the Show be held at Peebles, provided satisfactory financial and other arrangements can be made.

*Edinburgh Show*, 1907.

The Directors for the Edinburgh district were appointed as a Committee to look out for a site for the Edinburgh Show of 1907.

*Consulting Chemist.*

The minutes of meeting of this Committee, held on the same day, were approved. With regard to the vacant office of consulting chemist, it was resolved that it be left to the convener of the Science Committee and the Secretary to arrange for analyses for members until a successor to Dr Aitken is appointed.

*Abortion amongst Cows.*

The SECRETARY submitted a letter from the Council of the Bath and West of England Agricultural Society, asking their support to a proposal that the Board of Agriculture should appoint a Departmental Committee to inquire into the subject of abortion amongst cows.

The CHAIRMAN said the Science Committee had been considering this matter. It was left to the Secretary to communicate with the Board of Agriculture, with the view of active steps being taken to promote investigation.

*Milk Record Scheme.*

The SECRETARY said the Committee in connection with the Society's milk record scheme met that day, but the members were not in a position to consider the results of the current year. They recommended, however, that power be given to the Committee to carry on the scheme for another year, and perhaps also to prepare some modifications of the scheme, with a view to spreading the work somewhat wider. It was also agreed that the report on the results of the work for this year should be prepared as formerly. The report was prepared last year by Mr John Speir, who had promised to undertake its preparation again.

This was approved.

*Railway Rates for Home and Foreign Produce.*

The SECRETARY said the Board of Agriculture was very anxious to have evidence from Scotland as to the alleged preference given by railway companies to foreign produce over home produce.

The Board approved of the appointment of Mr John Drysdale, Port of Menteith, to give evidence on behalf of the Highland and Agricultural Society, as well as on behalf of the Scottish Chamber of Agriculture.

*Motor Car Act*, 1903.

The SECRETARY submitted correspondence he had had with the Secretary for Scotland regarding the amendment of the Motor Car Act, 1903.

The Board approved of the action of the Secretary.

*Grass Disease.*

The SECRETARY read a report prepared by Mr Clark, M.R.C.V.S., Coupar-Angus, regarding a fatality amongst cattle caused by "grass disease" at Blackhaugh Farm, Perthshire. The report was remitted to the Publications Committee.

*Rural Depopulation.*

A letter was read from Mr John Scott Dudgeon, suggesting that the Society should take into consideration the question of the best means of bringing the people back to the land.

Mr JOHN M. MARTIN thought this was a very important question, but, at the same time, he thought that the Board had nothing to suggest in regard to the question.

After discussion, the Secretary was instructed to place the matter on the agenda for a future meeting, at which there would be time for its discussion.

*The Tariff Commission.*

The SECRETARY read a letter from the secretary of the Tariff Commission, inviting the Society to appoint a witness to give evidence before the Agricultural Committee of the Commission. He explained that the Commission were anxious that the witnesses should be elected irrespective of their views on fiscal reform. The letter stated that the Commission would, later on, communicate with them as to the points of evidence desired.

Mr W. S. FERGUSON thought they should first of all ascertain of what nature the examination was to be, and of what nature the questions would be that the Commission intended asking. They could not send a representative of the Board to represent everybody. They were all at sixes and sevens on the question.

It was resolved to take no action in the matter.

*Aitken Memorial Fund.*

The SECRETARY reported that the fund organised for presentation to the widow and family of the late Dr Aitken amounted to £242.

The CHAIRMAN pointed out that if any one had inadvertently not taken advantage of the opportunity to subscribe to this fund, he or she could still do so through their Secretary, Mr Macdonald. This was their final opportunity. Dr Aitken, he said, had rendered very valuable service to the agricultural community.

*National Diploma in Dairying.*

The SECRETARY submitted the report on the recent examinations for the N.D.D. at Reading and Kilmarnock.

*Professor Wallace's Pamphlet.*

A letter and pamphlet by Professor Wallace, being replies to the report of the Special Committee appointed on 6th April 1904, were submitted.

It was unanimously agreed to take no further notice of the matter.

*Canadian Cattle Importation Association.*

A letter was read from the secretary of the Canadian Cattle Importation Association in Dundee, asking the support of the Society to the movement for the admission of Canadian store cattle. It was decided to take no action in the matter.

## MEETING OF DIRECTORS, 7TH DECEMBER 1904.

*Present.—Vice-President*—Mr Charles Howatson of Glenbuck. *Ordinary Directors*—Mr St Clair Cunningham, Hedderwick Hill; Mr Alexander Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; the Right Hon. the Earl of Mansfield, Scone Palace; Mr John M'Caig, Challoch; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr William Clark, Netherlea; Mr J. Ernest Kerr, Harviestoun Castle; Mr R. Sinclair Scott, Burnside; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Mr John Marr, Cairnbrogie; the Very Rev. John Gillespie, LL.D., Mouswald Manse; Mr Jonathan Middleton, Clay of Allan; Mr C. H. Scott Plummer of Sunderland Hall; Mr John M'Hutchen Dobbie, Camp nd; Mr William Taylor, Park Mains; Mr David Wilson of Carbeth, D.Sc.; Mr Thomas Gordon Duff of Drummuir; Mr H. M. Leadbetter, Legerwood. *Directors*—Mr James Campbell of Kilberry; Mr J. Campbell Murray, Haggs Castle; Mr R. G. Murray, Spittal; Mr R. Shirra Gibb, Boon; Mr John M. Martin, Murieston

House; Mr Robert Paterson, Hill of Drip; Mr John Ballingall, Dunbog; Mr F. W. Christie, Dairsie Mains; Mr John Wilson, Edinburgh; Mr John M. Aitken, Norwood; Mr James I. Davidson, Saughton Mains. *Treasurer*—Sir James H. Gibson-Craig of Riccarton, Bart. *Auditor*—Mr Wm. Home Cook, C.A. The Earl of Mansfield in the chair.

The CHAIRMAN, before commencing the ordinary business of the meeting, thanked them personally for their kindness in electing him as Chairman for another year's term. He trusted he would be able to carry out the duties to their satisfaction.

*Glasgow Show*, 1905.

*Appointment of Judges.*—The judges for the 1905 Show at Glasgow were appointed at a committee meeting immediately after the ordinary directors' meeting

*Judging Draught Horses.*—Mr R. SINCLAIR SCOTT moved as follows: "For the classes for horses and mares for agricultural purposes, six judges shall be selected without appointment to a particular section. Three of this number shall be allocated by ballot by the Directors on the morning of the Show to each section, only two to act in each class, the third to remain in attendance as umpire; the rotation of the judging being fixed in the order of the ballot, the judge first on the list will retire at the conclusion of the first class, and the third judge will take his place in the second class, and so on till the classes are concluded." In speaking to his motion, he said: No doubt most of them would know that, under the present system of judging, the gentlemen appointed as judges were subject to little politenesses on the part of exhibitors in their section during the interval between the day of their appointment and the day on which the Show was held. It occurred to him that, in moving this resolution for their acceptance, this arrangement would have the effect of entirely preventing any outside interference upon their selection. In this respect it commended itself to the Board as being, to some extent, a departure in the right direction. It was not an idea of his own It was carried out with success at the Hackney Horse Society's Show and other exhibitions. Considerable delay was also caused under the present system when the judges' opinions differed on any point. By this system which he proposed an umpire would always be at hand.

Sir ROBERT MONCREIFFE, Bart., seconded the motion, which was agreed to.

*Prize List.*—Reports of the Shows Committee of dates 1st November and 7th December were submitted.

With regard to the prizes in the cattle section, a letter was read from the secretary of the Dumbartonshire Agricultural Society asking the Highland and Agricultural Society to increase the amount of prize money offered in the classes for Ayrshire cattle, especially as the Show of 1905 would be in an Ayrshire district. In view of the consideration given to this subject last year, the Committee recommended that the allocation of prize money amongst the various breeds of cattle should remain as at Perth last year. This was agreed to unanimously.

A memorial had been received from breeders and exhibitors of Ayrshire cattle urging that enclosed stalls, such as are occupied by horses, be provided in the Highland Show for Ayrshire cows in milk and in calf. It was agreed to grant this request on condition that the exhibitors pay the extra expense.

The draught horse classes are to be as at Perth, with the addition of an extra class, the prizes in which are to be £6, £4, and £3, and are being presented by Mr Wm. Clark, Netherlea, for geldings in harness, which have been worked on the streets of Glasgow for three months previous to the Show.

It was specially provided that the acceptance of Mr Clark's prizes for animals drawn from a limited centre should not be held as forming a precedent.

In the hackney section the Committee recommended, on the motion of Mr C. J. Cunningham, that the class for stallions over 16 hands, and the class for stallions over 14 hands and under 15 hands, be made one class.

Sir ROBERT MONCREIFFE, Bart., moved, as an amendment, "That the classes be the same as at Perth." The animals exhibited in the respective classes mentioned were for breeding different types of the hackney, and he thought they should continue the two classes.

Mr JOHN M. MARTIN seconded, and Sir Robert's motion was adopted.

In the sheep section, the Committee recommended that the classes for Suffolks be discontinued. With reference to this recommendation a letter was read from the secretary of the Suffolk Sheep Society urging that the prizes for the Suffolks be continued.

Dr GIBB moved, as an amendment to the Committee's recommendation, that the classes for Suffolks be continued. Both Oxford Downs and Suffolks were very largely used as crossing sheep, and he thought they should be encouraged. This was agreed to.

The classes for swine are to be as at Perth.

The Committee's recommendation that the dairy produce—butter and cheese—should be judged by points was agreed to.

Several special prizes were accepted with the usual votes of thanks.

*Implement Trials.*—The SECRETARY reported that the Implement Trials Committee had met that day, and had completed arrangements for a trial of farmyard dung-spreaders to be held at Southfield, Portobello.

*Local Fund.*—Dr GILLESPIE asked the Secretary if he had received any further communication from the County Council of Argyll as to a contribution towards the funds of the Glasgow Show.

The SECRETARY stated that since the intimation that the County Council had not seen its way to agree to a voluntary assessment in aid of the funds of the Show, he had not received any communication.

Dr GILLESPIE said he believed he was correct in saying that for the last forty years there were only two counties (Argyll and Kincardine) which had failed to subscribe to the funds for the Show when the event took place in their district He hoped a very important county, such as Argyll, would not give them the cold shoulder, but would assist them by private subscriptions, if not by voluntary assessment.

## *Border Show of* 1906.

The CHAIRMAN said that, before going to the next item (the Border Show of 1906) on the agenda, they had to decide whether the matter should be discussed in private or in public.

On the motion of Dr GILLESPIE it was agreed to discuss the matter publicly.

The SECRETARY thereupon read a letter from the county clerk of Roxburgh, stating that that County Council had agreed to levy the ordinary voluntary assessment in aid of the Show, whether it was held at Peebles or not A letter from the county clerk at Selkirk intimated that his Council had postponed the consideration of a voluntary assessment in aid of the funds of the Show until spring. The Berwickshire authorities had sent a similar report.

*Letter from the N B Railway Co.*—The following letter was received from Mr D. Deuchars, superintendent of the North British Railway:—

"DEAR SIR,—I have been considering most carefully the intimation conveyed in your letter of the 8th inst., that your Directors had decided to hold the Highland Show of 1906 at Peebles, in the event of satisfactory financial and other arrangements being completed, but regret that owing to the difficulties of working over the single line we could not meet the requirements of the heavy traffic during the existence of the Show. For the first time the Show is proposed to be held at a station with a single line in each direction, and which is not equipped to accommodate a large temporary traffic such as arises. The Peebles line extends for over thirty-six miles, with a junction at each end with our main line, and as it is almost entirely single, the difficulty of working the heavy live stock and passenger traffic would practically be insuperable. Even assuming the company were prepared to go to a very large expense for the laying down of extensive siding and storage accommodation, the provision of additional signal-boxes, the extension of passing loop-lines, and other works, I am forced to confess that the congestion and delay to traffic which would undoubtedly ensue even then cannot be contemplated. I am sure you will bear me out in saying that on all previous occasions where the Show has been held on this company's line, or at stations served by our trains, we have endeavoured, as far as practicable, to cater for the traffic by the running of extra trains, granting cheap fares, and other facilities, so as to contribute to its success; but, in the circumstances explained above, I am reluctantly compelled to intimate that on this occasion we will not be able to issue cheap tickets or run excursion trains. I think it right to advise you thus early, in view of the responsibility which devolves upon the company with regard to the satisfactory conveyance of the large number of exhibitors and passengers who attend the Show. I need hardly add that we shall gladly make the usual arrangements at any place which the Society may fix upon, and where circumstances admit of a satisfactory service being given to all concerned. With regard to the last paragraph of your letter, I have to state it is our intention that the new station buildings at Peebles shall be completed before July 1906."

With reference to the above letter the following letter was received from Mr Millar, manager of the Caledonian Railway Co.:—

"DEAR SIR,—I have had my attention called to a letter addressed to you by Mr Deuchars, superintendent of the North British Railway, on the subject of the railway facilities to Peebles in view of the probability of the Show being held in that town in 1906, and I must say it is an unusual letter for a railway official to write. In draw-

ing attention to the well-known fact that the North British Co.'s line into Peebles is a single line, Mr Deuchars has omitted to point out that there is a second railway into Peebles; and, if it is assumed, as we may fairly assume, that the traffic from the East will be conveyed by the North British, and the traffic from the West by the Caledonian Railway, the Society, in holding its Show at Peebles, would have the advantage of two lines of railway, and, what is still more important for a Show of live stock and farming implements, of two railway stations. I am sure that this company and the North British Company will be able to make satisfactory arrangements at Peebles for dealing with both passenger and goods traffic in connection with the Show if it is finally decided to hold it in Peebles. I recollect the Show having been held at Melrose, where both the passenger and goods station accommodation is of a limited character, but, so far as I am aware, the North British Railway Company did not on that occasion raise any objection to the Show being held there. I have also to remind you that the Show has been held at Inverness without inconvenience to the exhibitors, although the Highland Railway is a single line from end to end. I have no doubt that so far as railway facilities are concerned, Peebles is better suited for the Show than any other station in the Border district, and, so far as my company is concerned, you may rest assured we will do everything we possibly can to give a satisfactory service to passenger, goods, and live stock traffic; and I may also state that I see no reason why the cheap fares usually given by the railway companies in connection with the Highland Show should not be extended to Peebles if your Directors decide to hold the Show there in 1906."

Sir JAMES H. GIBSON-CRAIG moved: "That, in view of the letter from the superintendent of the North British Railway, Standing Order No. 38 be suspended, so that the decision to hold the Show in 1906 at Peebles may be reconsidered." Dr GILLESPIE seconded

The CHAIRMAN explained that to carry out this proposal they required a two-thirds majority of those present.

On a show of hands being taken, 15 out of 34 present voted for the proposal. It was accordingly not in order to reopen the discussion at that meeting.

The SECRETARY stated that he had received a letter from the county clerk of Peebles asking if the Directors would receive a deputation in support of the claims of Peebles.

Mr J. M. MARTIN wanted to know what the deputation would discuss, seeing they had already decided to go to Peebles.

Dr GILLESPIE said, that in view of the letters submitted, he was in favour of a deputation being appointed to wait on the railway officials, and to see what could be done to overcome the difficulties.

Mr MARTIN said it was obvious from the letter and other things that if they went to the North British Railway Company they would get no satisfaction at all. The railway company would do everything in its power to thwart them. If they had definitely fixed for Peebles, then they could tell the North British Railway Company that, and ask them, "What are you going to do for us?" He thought the North British Railway officials had behaved in a very peculiar manner towards the Society.

Dr GILLESPIE moved: "That a deputation of Directors be appointed to confer with the officials of the North British Railway in order to secure proper railway facilities in connection with the proposed Show at Peebles in 1906."

Mr ST CLAIR CUNNINGHAM seconded.

Mr MARTIN moved, as an amendment: "That the consideration of Dr Gillespie's motion be deferred until the Directors' meeting in March."

Mr JONATHAN MIDDLETON seconded.

On a show of hands the amendment was carried.

*Agricultural Examinations.*

On the motion of Dr GILLESPIE, the resolutions regarding the new Royal Charter, which are to be submitted to the anniversary general meeting, and a copy of which had been sent to members of the Board, were adopted.

*Proposed Circuit of Shows.*

Mr JOHN M. MARTIN moved: "That a committee be appointed to consider the question of the circuit of the Society's Shows, with a view to suggesting some method for securing a more satisfactory rotation of districts than is at present adopted, providing for greater and more regular intervals of time between Shows held in adjoining districts." He thought they would all agree that it would be very desirable if they could find some way of returning to the old system. He had no scheme of his own

to propose, but the committee which he proposed to be appointed might be able to develop some scheme. The Committee consists of the Chairman, the Treasurer, the Honorary Secretary, Dr Gillespie, and Messrs Jonathan Middleton, Alex. M. Gordon, W. S. Ferguson, C. H. Scott Plummer, John M'Hutchen Dobbie, and John M. Martin (Convener).

*Grants to District Shows, &c.*

On the motion of Dr GILLESPIE the recommendations of the Show Committee in regard to the district shows were approved.

## MEETING OF DIRECTORS, 11TH JANUARY 1905.

*Present.—Vice-President*—Mr Charles Howatson of Glenbuck. *Ordinary Directors*—Mr St Clair Cunningham, Hedderwick Hill; Mr Alex. Cross of Knockdon; Mr A. H. Anderson, Kippendavie Estate Office; the Earl of Mansfield; Mr Wm. Duthie, Tarves; Mr John Cran, Kirkton; Mr James Stenhouse, Turnhouse; Mr Wm. Clark, Netherlea, Mr Andrew Hutcheson, Beechwood; Mr E. Douglas Paton, Broomhill; Sir Robert D. Moncreiffe of Moncreiffe, Bart.; Mr John Murray, Munnieston; Sir Archibald Buchan Hepburn of Smeaton, Bart.; the Very Rev. John Gillespie, LL.D, Mouswald Manse, Mr Jonathan Middleton, Clay of Allan; Mr C. H. Scott Plummer of Sunderland Hall; Mr John M'Hutchen Dobbie, Campend; Mr William Taylor, Park Mains, Mr W. S. Ferguson, Pictstonhill, Mr Thomas Gordon Duff of Drummuir; and Mr H. M. Leadbetter, Legerwood *Extraordinary Directors*—Mr J. Campbell Murray, Haggs Castle, Mr John Speir, Newton Farm; Mr Walter Elliot, Ardtornish, Mr R. G. Murray, Spittal; Mr John M. Martin, Midcalder; Mr C. M. Cameron, Balnakyle; Mr John Ballingall, Dunbog; Mr F. W. Christie, Dairsie Mains; Mr John Wilson, Edinburgh; Mr John M. Aitken, Norwood, Mr James I. Davidson, Saughton Mains; and Mr R. Shirra Gibb, Boon. *Hon. Secretary*—Sir John Gilmour of Montrave, Bart. *Auditor*—Mr Wm. Home Cook, C.A. The Earl of Mansfield in the chair.

*Finance.*

The SECRETARY reported that the Finance Committee met that morning, when they had before them the volume of accounts as prepared and audited by the auditors. The statement of accounts was signed by the members, as required by the charter of the Society. They had also before them the estimate as to income and expenditure for the current year.

*Glasgow Show, 1905.*

*Argyll Assessment.*—The SECRETARY said he was able to announce that the Commissioners of Supply for the county of Argyll had arranged to raise a local fund in aid of the expenses of the Glasgow Show.

*Forage.*—The SECRETARY reported that the Committee appointed to consider tenders for the supply of forage at Glasgow Show met that forenoon. They considered tenders received from four firms, and recommended that the tender of Mr Andrew Motherwell, Gorbals Grain Stores, Glasgow, be accepted. The prices were very similar to those of previous years.

This was agreed to.

*Appointment of Stewards*—The Stewards were reappointed as follows: Cattle, Dr Gillespie; horses, Mr W. S. Ferguson; sheep, Mr J. Wilson; parade stand, Mr St Clair Cunningham; gates, Mr J. M'Hutchen Dobbie; implements, Mr J. Middleton; and forage, Mr W. T. Malcolm.

*Catering.*—It was resolved that the five licensed caterers who had booths at Perth be again appointed—viz., Mr Hay, Aberdeen (Committee Booth); Messrs Wilson & M'Phee, Glasgow; Mr John Brodie, Dalkeith; Messrs White & Smith, Glasgow; and Mr M'Cracken, Perth. It was also agreed that the tea pavilion be under the management of the British Women's Temperance Association (local branch).

*Implement Trials*—Authority was given to the Implement Trials Committee to carry out a proposal by Mr John Speir that a variety of gas engine on the suction principle be put on its trial at the Glasgow Show.

*Implement Stands.*—The SECRETARY explained that in the Showyard at Glasgow they would not have the usual amount of space available for the show of implements and machinery. There was no doubt their usual space would be curtailed. He was unable to say at present to what extent, but it would be something considerable.

Under the circumstances he asked for the assistance of a Special Committee in allocating the space to the various exhibitors.

Mr MARTIN thought this should be done. They should put a note in the Regulations, in a prominent place, stating that, on account of the limited space at their command, exhibitors' stands would have to be limited.

The SECRETARY suggested that a note be inserted to the effect that the Directors reserved to themselves the right to allocate either the whole of the space applied for or such portion as was available.

This was agreed to, and authority was given to the Chairman of the Board and the Steward of Implements to advise with the Secretary as to the allocation of space at this year's Show.

Sir JOHN GILMOUR asked how it would do for them, as a Board, to say that they considered that no duplicates of implements be sent. It was quite unnecessary to have in a Showyard rows on rows of duplicates. They were there evidently for sale. He thought the attention of exhibitors should be called to the fact that duplicates would not be allowed in the yard.

Dr GILLESPIE supported Sir John Gilmour's remarks. He thought that this was a good time to adopt a rule which would have the effect of precluding duplicates at all their Shows. He thought it was to the interests of the buyers of implements and the general visitors to the Show that they should have such a limitation.

Mr DUTHIE said they would better leave it in the hands of their Secretary and the Committee, who, he felt, would act with all wisdom in the matter.

Sir JOHN GILMOUR thought there was opportunity in this. He thought that at Shows it was not absolutely necessary to have a whole lot of the same implements exhibited for a sale. It would be as satisfactory to intending buyers to have one. This was a good opportunity to tell the exhibitors that, looking to the position they were likely to be placed in, they should curtail the number of their exhibits.

Dr GIBB thought the matter was being brought up in rather an unconstitutional manner. He was not prepared to say right off whether or not he could agree to the proposal to have no duplicates. He thought that the right way would be for the Committee to bring up a report on the subject.

Mr DUTHIE explained that the reason why he suggested that the matter be left to the Secretary and Steward to deal with was that the same point had been raised at the Royal Northern Agricultural Society, and they found it was not practicable to deal with it with a strong hand, as was now proposed, and he thought they should give the matter further consideration There were certain implements of which it was absolutely necessary to have duplicates at a show. The matter should be left open in the meantime.

The SECRETARY said the matter mentioned by Sir John Gilmour was one that would have to be taken in hand soon, and he had it under his consideration, but he thought it would be well not to attempt to deal with it this year.

Sir JOHN GILMOUR, in answer to the Chairman, said that he did not wish to press his suggestion, seeing that the Secretary had the matter under consideration, and as it could not be decided in the time at their disposal, they would trust to the Committee to deal with the matter for this year.

*Forestry Exhibition.*—The SECRETARY reported that he had asked the secretary of the Royal Scottish Arboricultural Society to inform him if it was the desire of his Society that the prizes for timber at the Show in the forestry section should be confined to Scotch-grown timber, or should be open to timber grown in any part of the United Kingdom. His reply was to the effect that his Council unanimously agreed that the competition should be open to the whole of the United Kingdom, and they hoped the Highland Directors would agree to this.

The suggestion was approved of, and it was formally agreed to give the usual space for the forestry exhibits, and a grant of £20 for the prizes for timber.

*Pony Classes.*—The Committee appointed to revise the whole of the pony classes met that day, and they recommended that the ordinary pony classes remain as at Perth—viz., Classes 64 to 68—as to the money and classification, but that in Class 68, for small ponies, the animals be shown in hand and not in saddle. It was further recommended that these classes—64 to 68—should be judged by the Hackney judges if found practicable, and that it be so stated in the premium list. The Committee further recommended a new class for riding cobs, or pony mares or geldings, 13·2 to 15 hands, shown in saddle, with prizes of £5, £3, and £2. It would be open to unpedigreed animals, and was practically a class for farmers' cobs. It was recommended that the polo and riding pony classes remain the same as at Perth, also the Shetland and Highland ponies.

A letter from Mr Munro Mackenzie, Calgary, was submitted, desiring separate classes for Highland ponies of the thick garron type, and for those of a lighter type, but the Committee could not see their way to recommend the adoption of this proposal.

The recommendations of the Committee were adopted.

*Harness Classes.*—The Committee were instructed to consider the classes for harness horses, and, as there was an exceptional interest taken in this class of stock in Glasgow, it was thought that there should be additional classes. A letter was read from Mr Archd. MacNeilage, Secretary of the Scottish Committee of the Hackney Horse Society, urging that there be at least six driving classes.

The Society's Committee recommended that six classes be arranged, and that the Society vote a sum of £140 towards the prizes, efforts being made in Glasgow to raise a contribution for the prizes for these classes.

Dr GILLESPIE remarked that the Treasurer was not there, and he was not his substitute, but they should look to their finances. They were proposing a very large increase for one section. He moved that the whole question of the driving classes be deferred till next meeting.

This motion was not seconded

The CHAIRMAN—I think Dr Gillespie's caveat is well worthy of attention, and I think it should be divided on, but the feeling of the meeting seems to be against it in the meantime.

The recommendations of the Committee were agreed to.

*Van Classes.*—Intimation was made of £10 in prizes, per Mr Wm. Taylor, for mares or geldings, three years old or upwards, suited for heavy van purposes, but it was agreed to defer consideration of the regulations till next meeting, the Directors agreeing to supplement the prizes to the extent of £10.

*Ayrshire and Clydesdale Derby Classes.*—Application was made by the Glasgow Agricultural Society for permission to award their "Derby" stakes for Ayrshire cows and Clydesdale colts and fillies in the Highland Show By stopping the Glasgow Show they broke the continuity of these "Derby" classes, and it would be remembered that when the Show was held in Edinburgh in 1893 the Society was allowed to award the stakes in the Highland Show. The animals were also entered in the ordinary classes, but were judged separately for the "Derby" stakes.

This was agreed to on the same conditions as at Edinburgh in 1893, it being understood that the Derby prizes would be awarded by the Highland and Agricultural Society's judges.

*Special Prizes.*—A number of special prizes were accepted, with votes of thanks to the donors.

*Border Show*, 1906.

Mr JOHN M. AITKEN moved—"That the financial and other arrangements now offered by the Border Counties for the holding of the Highland Show of 1906 in the Border district be regarded as satisfactory." He was tied down by their rules to this stereotyped form of motion His object in moving it was to bring to an end the friendly rivalry which had been taking place between certain counties and certain railway companies in regard to this Show. So far as the counties were concerned, the chief contention was between the Peebles and the Hawick site; but the Hawick people, through the Teviotdale Farmers' Club, on 2nd December, while expressing some little dissatisfaction that the Show was to be at Peebles, suggested a small circuit for the holding of the Show: namely, at Melrose, at Kelso—where the Show had already been held—then at Peebles, and lastly with themselves. He thought that as far as the Hawick people were concerned they were prepared to accept the situation, and Roxburgh had fallen into line. The financial and other arrangements had always been very vague and indefinite, but they might consider the "other arrangements" first. He supposed that referred to the site He thought that no possible exception could be taken to the site. The other point was the railway arrangements. He thought they would leave these to the managers of the railway companies. They had always succeeded in managing matters in the past to the satisfaction of the Directors. As regards the financial arrangements, he might mention that when the Show was to be held at Kelso, it was reported that the sum of £600 was guaranteed, and this was characterised as a larger sum than had been raised by any centre in the history of the Society What were the Peebles people prepared to do? In Kelso in 1880 the Agricultural Society of the district gave £100, the town £55, and the counties £990, or £1145 in all. Melrose gave £10, 10s. from the Agricultural Society, nothing from the town, and £792 from the counties, or £802, 10s. in all. In 1890, for the Show at Kelso, the counties gave £869, the Agricultural Society £210, and the town £300, or £1379 in all. The Peebles contributions promised to date were £105 from the Agricultural Society and £585 from the town, or £690 in all, as against £500 from Kelso. There was £115 for special prizes, and it was reasonable to expect that they would have £1400 or £1500 altogether, or considerably better than they had at Kelso, which was characterised as the best ever got in the history of the Society.

Mr HUTCHESON seconded.

Mr Scott Plummer moved the previous question, as he thought it was a little gratuitous to say that the financial and other arrangements were satisfactory. A large majority of agriculturists in the Border districts lived in Berwick and Roxburgh, and the manager of the North British Railway had said that if the Show was held in Peebles he would not agree to run any special trains. If they were agreed that the arrangements were satisfactory, it would not be homologated by the residents in the Border district. At this time they really had a most unsatisfactory arrangement as regards the railway company. He thought it would be very gratuitous for them to go out of their way and say that they were satisfactory. He moved that they take no action in the matter.

Mr Martin, in seconding, said that they might take it for granted they might go to Peebles now, but he could not see why the hands of the Board should be forced. As far as he was aware, things being satisfactory they would go there, and they had never been in the habit of saying anything further. He did not see why they should stultify themselves by saying that what they had already received as contributions was quite satisfactory.

The Secretary read at this point a letter from the county clerk of Berwick, saying that his Council thought that the Show should be held at a place in the Borders more convenient than Peebles, and they would suggest that Melrose would be a suitable centre.

On a vote being taken, Mr Aitken's motion was carried by 16 votes to 6

*Joint Show at Inverness.*

It was agreed, on the recommendation of the Shows Committee, to give a special grant of £25 in aid of the prize fund for a joint show to be held at Inverness next summer.

*Agricultural Examinations.*

The resolutions to be submitted by the Board to the general meeting on this subject, and which are given in the report of the meeting, were approved of.

*Kilmarnock Dairy School.*

It was agreed to recommend the renewal for this year of the annual grant of £100 to the Kilmarnock Dairy School.

*Forestry Grant.*

It was resolved to recommend that the grant of £50 to the lecturer on forestry in the University of Edinburgh be renewed for this year.

*Milk Records.*

The Milk Records Committee recommended that the report of Mr Speir on the work during 1904 should be published in the 'Transactions,' but that the farms be designated by letters instead of the names being given.

Mr Speir explained that people did not want their names published in the report, for various reasons.

It was reported that arrangements had been made for the working of the scheme under the direction of the Fenwick Farmers' Club, and that the tests were to be taken for a full year.

A letter from Mr Allan Barns Graham, in which he urged the Society to establish milk testing stations in different parts of the country, was considered. The Committee approved of this proposal, and were glad to learn that through the agricultural colleges the idea was likely to be given effect to, it being understood that the Highland Society would help in the way which they might consider most advantageous from time to time.

The West of Scotland College made application for a grant for a scheme of milk testing at Kilmarnock Dairy School. The Committee could not see their way to recommend this, especially as it was explained that it was only the milk of the cows of the dairy school farm that are to be tested in the meantime.

Dr Gillespie said that it should be emphasised that two of the colleges have made arrangements for testing samples of milk for a small fee, and in an authoritative way. The West of Scotland College had been in the habit of conducting these tests on a small scale free of charge, and they proposed now to do them on a larger scale for a very small sum. This should be widely known, in order that owners of cows might take steps to get the produce of their animals tested.

The recommendations of the Committee were approved of.

# PROCEEDINGS AT GENERAL MEETINGS.

## SPECIAL GENERAL MEETING, 6TH APRIL 1904.

A special general meeting of the members of the Highland and Agricultural Society was held in the Synod Hall, Castle Terrace, Edinburgh, on Wednesday, 6th April 1904. The EARL OF MANSFIELD, the President of the Society, occupied the chair, and there was a large attendance, over 700 members being present.

The PRESIDENT, in opening the proceedings, said,—I think it only right to suggest to you for your approval that, as there is likely to be a considerable amount of talking at this meeting, and many of those present wish to leave by early trains, I propose to limit the speeches of the mover of the motion to be made on behalf of the Directors and of the mover of the principal amendment thereto, if there be such, to the period of fifteen minutes each, and that all other speakers be limited to five minutes. I understand that you approve of that. I hope, gentlemen, that it is understood by all that we are here as a business meeting, and that no personalities will be alluded to. Unfortunately there have already been a considerable number of allusions of a personal nature, and I beg to inform you as a general meeting of this Society that the Directors have, at the request of the Secretary of the Society, and for the general satisfaction of all concerned, appointed a committee to go into some of the charges that have been made, and to report to you at a future public general meeting. I now call upon Sir Ralph Anstruther to address you.

SIR RALPH ANSTRUTHER said: My Lord and Gentlemen,—I have been requested, as having held the honourable position of Chairman of the Board of Directors at the time when the new charter was applied for to his Majesty the King, to lay that charter on the table. I think it right to state, in a very few words, the position in which we stand with regard to this charter. The charter was found necessary in order to remove certain legal objections which were supposed to exist in the position of the Society as it was last year. A charter was granted in the year 1856, by which a committee was appointed to take charge of the educational work of this Society. That committee worked more or less for a good many years, but it was found necessary to make changes, as changes so often have to be made in the life of a progressive Society such as ours, and the Directors unanimously came to the conclusion that some change was necessary with regard to the Council on Education, as the body was called. Everybody connected with the Society cordially welcomed the proposal that a change should be made, and it was decided that in lieu of the work being carried on solely in this country, it should be carried on jointly by the Royal Agricultural Society in England and our own Society in Scotland. The members of the Council on Education and the old examiners did not merely approve of the proposed changes, but they were good enough to give valuable assistance to the Directors in adjusting the syllabus, and the scheme was submitted to the Society and adopted unanimously. The Directors, in furtherance of their remit, carried out the work under this new arrangement from 1899 until last year, when the question was raised as to whether, under a strict reading of the old charter, the new departure was absolutely legal. Professor Wallace obtained a legal opinion that such was not the case, and of course the Directors took the matter up. The legal advisers of the Directors did not accept what I think is a comparatively narrow view of the powers of the Board under the old charter; but, when they went into the matter, they came to the conclusion that, rather than run any risk and occupy themselves with controversy on the point, the proper course would be to apply to the King for a new charter, so as to place their ambiguous powers on a perfectly safe footing. The petition which was framed for the new Royal Charter was duly submitted to and unanimously approved of by the

society. The petition went before the King, and his Majesty was graciously pleased to accede to the prayer of the petition. The charter gives power to the Society at a general meeting called for the purpose to decide whether the Society's educational work is to be conducted by the old semi-independent Council of Education, or whether the members of the Society are to assert themselves and control their work of education as they control all other spheres of their activity. That is, I hope, an impartial and complete statement of the position of matters in regard to this charter, and I beg formally to lay the new charter upon the table.

The Rev. Dr GILLESPIE said: My Lord Mansfield, my Lords and Gentlemen,—I have the honour, at the request of the Directors, to move the following resolutions—"That in accordance with the powers conferred upon the Society by the Supplementary Royal Charter granted by his Majesty the King on the 16th January 1904, the Society resolve as follows, viz.: (1) That the Council on Education appointed by the Society under the Supplementary Royal Charter of 1856 be discontinued for the present, and (2) that the Board of Directors be authorised and instructed to take all steps they may consider necessary and expedient for carrying on the Society's educational work and conducting examinations and granting certificates and diplomas." Sir Ralph Anstruther has referred to the diploma originating in 1899, but I may remind the meeting that the idea of having a National Diploma originated with the Board of Agriculture. So long ago as 1889 that Board addressed a communication to this Society suggesting the establishment of a joint diploma. In 1891 a conference was held in London at the request of the Board of Agriculture, at which all the important agricultural societies were represented, and a scheme was formulated; but after consultation with the legal advisers of the Crown it was found that it was not competent for the Board of Agriculture to carry out the scheme without fresh legislation, and as the Government of that day was not prepared to introduce legislation the proposal stood in abeyance for some years. Then the Board of Agriculture made a renewed request for a conference. That conference was held, and in 1897, by the unanimous resolution of this Society and the Royal Agricultural Society of England, the Dairy Diploma was instituted. The examination for that diploma has been held at Kilmarnock and Reading for seven years, and annual reports have been presented regarding the results. Last October there were 31 candidates; 21 got the diploma, of whom 11 passed at Reading and 10 at Kilmarnock. All those who passed at Kilmarnock were educated there, and the half of one of the others was educated in Scotland. That, so far as Scotland is concerned, is entirely successful. It was so successful that it eventually led to the establishment of the National Agricultural Diploma, to which Sir Ralph Anstruther has already referred. The question of joining in this National Diploma was approved of at two general meetings of this Society. It was approved of by the Council of Education, approved of by the Directors of the Society, and by the Society's Board of Examiners The Board were unanimous at that date as to the value of the scheme, and they are equally unanimous and even more enthusiastic as to its value at the present day. No scheme ever launched received a greater or wider chorus of approval People were vying with each other to blow wind into the sails of this newly launched ship, with such favour was it received, and the Directors have had no reason to change their views. The object of the National Diploma was to provide a stimulating and guiding influence to those entrusted with the management of agricultural schools and colleges—a stimulus to these bodies to extend their facilities for providing improved scientific and practical instruction in agriculture, and a guide to them in adjusting the lines upon which the desired advance should proceed. In 1899 the unanimous opinion was that these important objects would be best accomplished by a National Diploma, and that is the reason why the steps were taken, and the result, I submit, has justified the scheme. It has helped to guide agricultural education. It has set up a very high standard—a gradually raised standard—and I need not remind you that the higher the standard of the main agricultural diploma in Great Britain, the higher will be the standard required for every diploma given by all the agricultural colleges or other institutions throughout the land. I need only remind you of the comparative value of a College diploma and a National one. People are apt to get confused and even bamboozled over too many different diplomas, and especially a distinctively Scottish college diploma is in danger of being thought to be more or less provincial. I hope and believe that our agricultural colleges, which are developing on most satisfactory lines, and are satisfactory in all respects, will by-and-by become so efficient that even their diplomas will rank as high as any diplomas in the kingdom. As chairman of one of these colleges, that is my ardent hope, and I hope I will live to see the day when that is accomplished. Until then, at all events, this National Diploma is the highest hall-mark in the agricultural department, and it is most important that it should continue. Its value is recognised by the national agricultural bodies throughout the kingdom. There are two bodies which distribute the grants available for education in England and Scotland. The one is the Board of

Agriculture in England, and the other is the Scotch Education Department, and each of these departments, to the intense delight of the Joint-Board, have agreed to send a representative to be a member of the Joint-Board, and to take part in the management of this excellent scheme. That shows the advance that is being steadily made. I must explain as to the place where the examination has been held. The Council of Education recommended that it should be held in some such centre as Preston, which might be said to be central so far as both England and Scotland were concerned. As a member of the Joint-Board, and being its chairman for the third year, I can testify as to everything that has been done, and I have taken a most active interest in all its concerns. We discussed as to where it would be best to hold the examination, and we had in view a central place, and solely as a tentative scheme we agreed to take Leeds as a central place. It is by no means an essential part of the scheme that the examinations should take place at any one centre, and as far as the Directors are concerned and the Board in England, if the time is ripe, and I believe it is ripe, the examinations should be held each year in England and Scotland, or alternatively. This is entirely a matter of adjustment, and I assure you that whatever the wishes of the members of this Society are they will be most loyally carried out, and will receive no objection from the English Board, who have shown the Scottish members every courtesy. In fact, I sometimes think that we from Scotland get a little more attention from them than our inherent merits deserve. There is no subordination of Scotland to England in this matter. As to the way in which the examinations have been conducted, I may say that since they were started I have been present at all the examinations except the last one. Unfortunately I took a week's illness at the end of last year, and in view of the other work which I had in hand it was thought that I should not risk myself, so that I was absent from the last examination in the first week of May. I was present when all the other examinations took place, and I have listened to the oral examinations. As a man who was at a university for eleven years, and as one who has had a great deal to do with education, not only agricultural but otherwise, I submit I have some slight qualification for judging as to examinations. I can testify that this examination is conducted by most efficient men, with perfect fairness, and with the view of testing the qualifications of the students and giving them every consideration. I give you warning, that if this scheme is knocked on the head it will put the agricultural education clock far further back than anybody realises. Agricultural education is making excellent progress. It has been my pet hobby, some people say more my pet hobby than Church matters—I do not discuss that—but it is very close to my heart, and nothing has given me more pleasure than to see the immense progress of agricultural education in recent years. I implore you to do nothing to impede its progress. Continue the examination, and if circumstances change and if it is thought desirable and necessary to modify the arrangements, that can be done when the time comes. Let us do our duty to-day and leave those who come after us to do theirs.

Mr A. M. Gordon of Newton said: My Lord Mansfield, my Lords and Gentlemen, —I have been greatly honoured in being asked to second the resolution which has been so well and so lucidly explained to you by the Very Reverend Moderator of the Church of Scotland. It is unnecessary for me to amplify or attempt to explain further what he has so well put to the meeting. I will only say that it seems to me that these resolutions are but the logical outcome of the situation as it exists at the present moment. Either by your presence or your silence, which gives consent, the whole body of this Society in June last authorised the Directors to go to the King and ask for this supplementary charter to carry out the objects we are endeavouring to carry out. His Majesty in his gracious wisdom has been good enough to give us this charter. Shall we, if we do not carry out the provisions of this charter, be the logical practical Scotsmen we are supposed to be? I say no. There is one manifest course at present, whatever we do in the future. We cannot forecast the future, but in the present the only course to follow is the one indicated in the resolution which the Rev. Doctor has so well put before you. I beg to second the resolution.

The Secretary intimated that he had received a letter from Mr Gavin W. Ralston, Advocate, stating that he withdrew the motions of which he had given notice for this meeting.

Professor Wallace,—I have, as a matter of duty, to propose as an amendment to this resolution the previous question as to the first section of it, and to add to the second section the words: "Employ the Council on Education detailed in the Society's New Charter on Education." We have heard that the Society went to the King in Council to get this new charter; but what did they do? They put in the forefront of the petition the Council on Education which was in the old charter, and they said it had done good work. What we have to consider is the question of the merits of the two authorities on education, the Council under the old charter, and the efforts made for the last four years under the direction of the Society, who discarded the old Council to simplify matters. I sent down a number of statistics. If the Direc-

ters had had statistics they would have circulated them to go by, but you have no results to go by from that side. What I want to show are the results for four years under the two systems. The Highland Society gave 39 diplomas to men coming up to examinations in Scotland, or 10 annually. The Royal Agricultural Society gave 69, or 17 annually. Those two Societies for four years gave 108 diplomas, or an average of 27 annually. What has this new authority done for education? For four years the combined authority has only given 33 National Diplomas, or an average of 8 annually—a most miserable result so far as diplomas go. Every diploma that comes to Scotland costs the Highland Society £100. I call that a ridiculous waste of public money. There is no diploma on earth worth £100 to the Society. That is not the end of the cost. What does it cost to the student? He has to make two journeys costing £7 each to go to Leeds, £14 to a man who takes it without failure. But the Society has established a record of two failures for every pass. I call that a disgraceful miscarriage of justice. It is nothing short of barbarous that any Society should ask men to come from all parts of the country to that examination and fail two out of three of them. It is nothing short of gambling. It is as bad as going to Monte Carlo, and for the Highland Society, after this has been pointed out to them, to insist upon these young fellows to come forward and spend all that money—I think this meeting will not support it. In criticising this I am not standing alone. I am at one with practically all the leading agricultural teachers in the country. This is a communication which was made to the joint-body from an association which contains nine-tenths of all the agricultural teaching authorities in the country: "The examination as now conducted is not in that full touch with the ordinary course of study as carried out in the generality of colleges conducting agricultural education as it is desirable on all grounds that it should be. The result is that those pupils who, under the direction of their teacher, are intending ultimately to present themselves for examination, have to be to some extent withdrawn from the normal course of instruction and submitted to a course of special preparation for one examination." Cram, gentlemen, cram for this examination. "It is sufficient merely to state this to ensure unanimity of opinion that such procedure militates most strongly against that thorough educational efficiency which is without doubt the aim of all connected with the examination to promote." Cram, gentlemen, they are taken out of their ordinary courses and crammed. That is not my opinion, but the opinion of the teachers of Great Britain - England, Scotland, and Ireland. Education is a practical enterprise, gentlemen. It is like agriculture, it is like engineering, and you must associate with it practical men, the men who have gone through the course and men who have taught and examined, and unless you do that you will not get a diploma worth anything. The association further urged that "Associated with the examiners there should be men now or recently engaged in teaching agricultural students." What kind of a show would you have if all the men who owned stock were excluded from judging? What kind of a show would you have if all practical agriculturists were excluded from its management? What kind of a bridge would it be if you excluded from its erection everybody who knew about engineering? You must associate practical men, you must associate educational experts with all these examinations. That is what the associated teachers have told you is the cause of the failure. What does the press say? 'Nature' last June devoted two columns to a criticism of the action of this joint board, and the article was referred to in the London 'Times.' 'The Times' said: "An article in 'Nature' directs attention to the fact that 'a so-called National Diploma in the science and practice of agriculture can now be obtained by any student who passes the necessary examination,' but it is maintained that the diploma in question has no right to the title 'National.' It is granted by a joint-committee of two agricultural societies—the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland—it should therefore be designated 'the Agricultural Societies' Diploma.' To claim for it a National importance, and thus to imply that it ranks above all other agricultural diplomas, is, it is contended, simply to mislead the public and to assert a position to which it has absolutely no right. After describing the origin and history of the 'National Diploma,' it proceeds to say that if the diploma is to be really national, if it is to be stamped with a national authority, the schemes of education and examination laid down must not be decided on by the members of two agricultural societies. An outline is given of a committee which would be truly national, and it is added that 'until such a general body is constituted and authorised to grant diplomas it is a misuse of language to speak of a National Diploma in agriculture or dairying.' As to the examination itself, 'Nature' expresses the opinion that 'the character of our whole system of agricultural education depends on the standard set by what is apparently its highest grade. The present diploma has been given a title to which it has no right, and it has failed to justify by its excellence the rank which has been sought for it.'" (A Voice—"Who wrote that?") I was in the Argentine in June and did not know anything about it till I came home. What does 'The Times' say yesterday?

"Many efforts have been made, both by individual teachers of agriculture and by leading agricultural teachers working in conjunction, to induce the Joint-Board to alter its regulations to bring them into harmony with educational authorities; but the Board being out of touch with educational experts, and practically under the guidance of paid officials without any scientific training as educationists, has declined the only assistance that could place the examination on an educational basis. A solution of the difficulty in the immediate future is now feasible. The educational field, so far as diplomas and degrees in agriculture are concerned, is about to be completely filled by the degree in agriculture to be given by London University, and by the diplomas of the three Scottish Colleges of Agriculture, arrangements for which are now undergoing consideration. A diploma in agriculture forced upon the educational world by a non-educational authority in competition with two such stamps of educational merit is bound to go to the wall, and may be left to a well-earned fate, by a natural death."

Rev. Dr GILLESPIE,—Who wrote that?

Professor WALLACE,—I did, and my name is there too. The reports of the Board of Examiners show that "the general standard of the students who came forward is lower than before." They added that "this may have been due to the youth of the students." This body is drawing young boys from schools who have no claim to the diploma. They are getting younger and younger every year—those who go up. "The large proportion of failures shows that many of the candidates presented themselves after very insufficient preparation. This is especially the case as regards Part I." As many as twenty-two of the unsuccessful candidates failed to pass in all subjects, or all except one. Fancy an examination so much out of touch with pupils that so many as twenty-two failed to pass in every subject except one. It is perfectly beyond comprehension that an examination should be held bringing up students of that kind. A great deal of capital has been made out of those eighty men presenting themselves for examination. Many of these men have come up after failure—fifty-two last year and thirty-two the year before—eighty four in two years. Eighty-four have failed in two years. There is an inducement in the £7. This gambling spirit has got into them. They spend £7, and they come up again and they spend another £7, but they fail. This represents a capital of £600 which those young fellows have spent. My motion is that the Council of Education should be associated with the Directors, and to advise and help and guide them, so that this absolute muddle may be got out of. I don't want to stop this diploma hurriedly. Its fate is certain within two years, but we must do something to give these young fellows fair play. I have to ask Mr Irving, a man who took the diploma, and a large landed proprietor in Australia and also in England, to second my motion He is an Englishman, but he speaks with a knowledge of the Scottish training. I have asked him to second the motion as a special favour, because I don't want a man to second me who will cut me to pieces, as is sometimes done. This man knows the whole business, and I call upon him to second the motion.

Mr R. J. IRVING, Edinburgh,—My Lords and Gentlemen, I have much pleasure in seconding Professor Wallace's amendment. I understand by that that what we propose now is that the old Council of Education should stand instead of the National Agricultural Examination Board. I think we are at one in considering that agricultural education is desirable and necessary You are here to look after the welfare of your sons. They will probably be educated in scientific agriculture. I think we might look on this from an educational standpoint, and look at the original Council of Education appointed by charter. They are the President of the Highland Society, the Lord Justice-General of Scotland, the Lord Advocate, the Dean of the Faculty of Advocates, the Professors of Agriculture, Political Economy, Anatomy, Botany, Chemistry, and Natural History. As far as the Highland and Agricultural Society was concerned, the names were the Master of Polwarth, Sir J. H. Gibson-Craig, Colonel R. G. Wardlaw Ramsay, Mr W. J. Maxwell, yr. of Munches. Dr Gillespie, Mr Marr, and Mr Cross. The representatives on the National Examination Board now are the Rev. Dr Gillespie, Mr D. Wilson of Carbeth, Mr Cross of Knockdon, Mr Speir of Newton, and the Secretary, Mr James Macdonald. I think that, looking at these two Councils from an educational standpoint, no one can doubt that the new body would be strengthened in their opinions by the opinions of the educational authorities on that first body. There are a number of men who are not there—six professors, besides the Professor of Agriculture, associated in the original body. I think what you want your sons to be taught is a real scientific education. When I started in the course some fifteen years ago I took into consideration, and my friends considered with me, three schools of agriculture—two in England and one in Scotland. I came across the Border. I think at that time Scotland stood alone so far as agricultural education was concerned. There is no reason why it should not be so now. It is for you to decide to give your sons a thorough education in scientific agriculture. There are now instead of three colleges, thirty colleges up and down the

country. Multiplicity does not mean efficiency, and what you want is to see that you get a thorough course of instruction—that you get in Scotland one or two absolutely efficient training colleges. I have very much pleasure in seconding Professor Wallace's motion, and I hope you will be able to find some scheme whereby you can establish a training college second to none in the world. I have much pleasure in seconding both sections of the amendment.

Mr ARCHIBALD MACNEILAGE, Glasgow,—As one who has taken some pains to understand this question, I wish to point out that, in the case of the speech made by Professor Wallace, his objection to the governing board of the National Diploma of Agriculture is based on the composition of the examining board, whereas the objection of his seconder is based on the composition of the governing board. Now, they cannot have it both ways. If their objection is to the examination board, that is a matter which admits of being put right in committee without any trouble; but as to the governing board, that raises a question of principle as to who is to have the control of national agricultural education in the country as a whole. And it cannot admit of dispute that it is of the utmost importance to agricultural education that those who compose the governing board should be practical agriculturists and not university professors, however eminent they may be. Professor Wallace took an objection to the new governing board because on figures it has passed fewer students than were passed jointly by the F.H.A.S and the R.A S E. Assuming the figures to be correct, what is proved by his figures is not what he seeks to establish. What is proved is that the standard of the new diploma is so much higher than the old ones, that in spite of the greatly increased facilities in this country, and the greater efficiency of the colleges, it is much more difficult to take a new diploma than the old ones. I cannot conceive that a company of intelligent men, having the desire to do the best for agricultural education, can have any objection to this. It must be admitted by every reasonable man that it is the chief merit of the National Diploma that it aims at a high standard, with the result that not merely does it pass men of high efficiency and high standard, but its high standard is the means of grading up the teaching standards of all the colleges and certificates that are granted. Professor Wallace took great objection to the examining board of the National Diploma in Agriculture He did not tell us who composed that examining board. I would wish that this splendid meeting of Scottish agriculturists would settle once and for all what is their opinion concerning the examining board for the National Diploma. There are two principles put before this meeting The first is that the examining board for the National Diploma shall consist of men who are absolutely free of bias in respect of the students who come before them—in other words, that no professor of any college shall have a say as to whether these students pass or not. Professor Wallace's point is that on this examining board there shall be professors who have an interest, who cannot fail to have an interest, not in all the students in common who come before them, but in one or two, or six out of thirty, who happen to have been educated in their colleges; and I ask any fair-minded man who is desirous that the best men should get the diploma, and that it should represent the best attainment, whether the principle adopted by the National Diploma is not an infinitely fairer one than the one Professor Wallace advocates. On the examining board the practical man, the practical farmer, holds the balance of power, and I maintain he is the right man to hold it in the case of a National Diploma.

Mr HEDLEY SMITH, Whittinghame,—I was a humble member of the directorate when this change was made—to combine the examinations of both Societies into one. I thought it was a good thing, because many of the Scottish students went to England and many English students came to Scotland, and it was a good thing to unite them in a National Diploma. It is, however, quite open to us to consider whether it has been a satisfactory scheme. Some members of the Society do not think it is satisfactory, and from the number of students who come to the examination it does not appear to be quite satisfactory or popular. It cannot be extremely popular if candidates do not go up. I should like to get more information. Why are the numbers of the successful candidates not mentioned in the 'Transactions' both in England and Scotland, and also the names of the examining board? We are told in a circular that there were eighty candidates, but it is not said whether they were in England or Scotland, or whether they went up for dairy diplomas. The dairy examination is held in the dairy district. If the dairy examinations were arranged along with the examinations for the agricultural diploma it would be an advantage. I was glad to hear the right reverend gentleman say that that might be considered. I am glad to see that not much has been said against the charter. It is merely confusing the issue, and is only a technical objection. I would move that the Directors be requested to give full information at the June meeting of the number of students who attend the next examination, whether in England or Scotland, and the names of the successful candidates. Mr MacNeilage has laid down one important principle—that the examining body should not consist of professors who have an interest in the students.

Who are the examiners in Edinburgh for the medical degrees? The professors who lecture to the students have a voice in the examinations. I think that, without moving any amendment, we might get more information.

Mr PETER FYSHE said it was men like himself who have young sons coming up for education who are entitled to speak on this matter, and, while he did not blame one side or the other, he most decidedly said there is a want of a curriculum closely connected with the upbringing of our farmers' sons.

Mr AITKEN, Norwood, Lockerbie,—I would like that we should have a clear understanding of the issue before the meeting. We have heard from Dr Gillespie that the effect of his motion would be to continue the National Diploma for a certain time, but we have not heard from Professor Wallace what this Council of Education would put in its place We have had for these last four or five years an examination which is recognised to be the leading examination in the country. We are not told by the mover of the amendment what is to be put in its place, and it would be absurd for us to swop horses in this way without seeing what like the other beast is. I think the true course for the Society to follow is to mark time for a year or two, because you have to bear in mind that we are to have a new college in Aberdeen. You have only recently established one in the east here. It seems to be the likelihood when these colleges get a little stronger that they may ask to have a joint-examination between the three colleges. I think that such an examination might probably very well take the place of the National Diploma, but it seems to me that the time has not yet arrived. I think before we begin to change again, not knowing what we are to have in the future, we should mark time, and I support the motion which has been made, so that we may know for some years what we are to get. I do not think that the Society will have more faith in the old Council of Education than they have in the present Committee of Education appointed by the Society, and in close living touch with the members of the Society

After some remarks by Mr Milne Henderson,

Rev. Dr GILLESPIE replied on the discussion He said,—As to the lack of students, you must first catch your hare before you cook it, and if Edinburgh had sent its fair proportion, equal to Glasgow and Aberdeen, the numbers would have been as large as in former times As to the examiners, for twenty years on the Council of Education I opposed the employment of teachers examining their own students, and I was looked at askance by professors and others, and was thought to be a revolutionist for proposing such a thing. We have steadily opposed that on the Joint-Board, but we have some ex-professors and teachers who are most valuable—more so than those teaching just now, because you cannot get the latter without bias. While human nature is what it is, you cannot get them free from bias. As to Mr Smith's remarks, the number of students quoted did not include dairy students.

Professor WALLACE asked and received permission to make a few remarks. What his motion meant was that the Council of Education should be associated with the Directors to wind up this business. It would take a year or two, and then the colleges could take the matter up themselves. It was a mistake to allow three or four men to wind up this bungle, and he hoped they would all support his amendment.

On a vote being taken on Professor Wallace's amendment by a show of hands, four members voted for it On Dr Gillespie's motion being put to the meeting as a substantive motion, it was carried with acclamation, two members voting against it.

Sir JOHN GILMOUR moved a vote of thanks to the Chairman, and the proceedings terminated.

## GENERAL MEETING, 1ST JUNE 1904.

The Right Hon. the EARL OF MANSFIELD, President of the Society, in the chair.

### *Office-Bearers.*

The SECRETARY submitted the following list of office-bearers, as recommended by the Directors:—

*President*—The Earl of Eglinton and Winton. *Vice-Presidents*—Sir John Stirling Maxwell of Pollok, Bart., M.P.; Sir John Ure Primrose, Bart., Lord Provost of Glasgow; Colonel Frederick G. Blair of Blair, C.B., Dalry, Ayrshire; Mr Charles Howatson of Glenbuck. *Ordinary Directors*—Colonel Dudgeon of Cargen; Messrs John M'Hutchen Dobbie, Campend; William Taylor, Park Mains; David Wilson, D.Sc., of Carbeth; W. S. Ferguson, Pictstonhill; H. M. Leadbetter, Legerwood; Thomas Gordon Duff of Drummuir; John Macpherson Grant, yr. of Ballindalloch. *Extraordinary Directors*—Sir Charles Bine-Renshaw, Bart., M.P., of Barrochan;

Colonel R. King Stewart of Murdostoun; and Messrs J. Campbell Murray, Haggs Castle; R. A. Oswald of Auchencruive; James Campbell of Kilberry; J. Windsor Stuart, Rothesay; J. Harling Turner, Portland Estate Office; John Speir, Newton Farm; Walter Elliot, Ardtornish; R. C. Murray of Spittal; R. Shirra Gibb, Boon; John M. Martin, Midcalder; C. M. Cameron, Balnakyle; Robert Paterson Hill of Drip; John Ballingall, Dunbog; F. W. Christie, Dairsie Mains; John Wilson, Edinburgh; Andrew Ralston, Glamis; John M. Aitken, Norwood; James I. Davidson, Saughton Mains.

*Perth Show*, 1904.

Mr W. S. Ferguson reported as to the arrangements for the Show to be held at Perth on the 19th July and three following days. A beautiful and unusually convenient showyard would be provided on the South Inch, and the town of Perth, besides giving the use of the ground free of rent, also undertook to let the Society have a supply of water free of charge. The County Councils, as usual, supported the Society liberally. The Perth Show division of the county of Perth contributed a sum of £412, 14s. 4d., and the county of Fife a sum of £378, 7s. 4d., raised by means of a voluntary assessment upon owners of lands and heritages. Contributions similarly raised are also proposed by the western division of Forfar and by the county of Kinross. A large collection of implements and machines have been entered. A trial of agricultural motors will be an interesting feature in connection with the Show. Entries of live stock do not close till Monday, 13th inst.

*Glasgow Show*, 1905.

Mr Alex. Cross reported that arrangements for the Show of 1905, to be held at Glasgow, progressed satisfactorily. With the exception of the county of Argyll, all the counties in the district had agreed to raise by voluntary assessment the usual contributions in aid of the expenses of the Show. It was much to be regretted that the majority of the Council of Argyll had not agreed to fall into line with the other counties, and make a voluntary assessment.

Mr MacNeilage explained that he understood the reason why the County Council of Argyllshire had done this was not because of any lack of courtesy towards the county or to its representatives on the part of the Highland Society, but because the majority of the Council shared the views of the late Sir Robert Menzies regarding the clipping of blackface sheep, and also some of the members felt rather strongly on the subject of representations made to the Board by the Highland Cattle Society. As he understood it, the complaint was not against the Highland Society for anything they had done, but rather because there was dissatisfaction with its policy in these two particulars.

Dr Gillespie said that the County Council of Argyllshire could hardly expect to control these interests. The Highland Society's Directors had done their best to meet the prevailing view regarding the clipping of blackface sheep and the date from which Highland cattle ages should be calculated. He hoped that the individual members of the Society in Argyllshire would contribute to the local fund.

The Chairman joined in this hope, and trusted the County Council would reconsider its position. If not, he hoped there were many friends in Argyllshire who would help.

*Border Show*, 1906.

Sir James Gibson-Craig, Bart., stated that the Directors had appointed a committee to consider and report as to the centre at which the proposed Border Show of 1906 should be held.

*Education.*

Dr Gillespie reported on the results of the examination for the National Diploma in Agriculture, held at Leeds on 9th May and three following days. In all seventy-five candidates entered. Three did not come forward, and one who began the examination took ill and retired. Of the forty-six who sat in Part I., thirty-five passed and eleven failed. Of the twenty-five who sat in Part II., twenty obtained the diploma and five failed. The gold medal for the highest number of marks in the honours list was won by Mr H. G. Hird, a student of the Yorkshire College, Leeds. Students from Scotland, eleven in all, made a very creditable appearance. In Part I., six came from the Glasgow and West of Scotland College of Agriculture. Five of these passed, and the other failed in one subject only. An English student entered from Edinburgh was unsuccessful in Part I. In Part II., two entered from Glasgow, one obtaining the diploma and the other failing. One student from Aberdeen obtained the diploma, as did an English student from Edinburgh. It is thus observed that of

eight students entered from the Glasgow and West of Scotland Agricultural College, no fewer than six were successful. Moreover, it should be mentioned that Mr John Struthers, the Glasgow student who obtained the diploma, had the highest number of marks over the two parts of the examination, and only lost the gold medal by having a few marks under the honours level in agriculture.

Mr HEDLEY SMITH asked if the names of the successful candidates could be printed in the 'Transactions.' He moved accordingly.

Mr GEORGE PRENTICE seconded, and it was unanimously agreed to.

*Science Department.*

Dr WILSON of Carbeth, Convener of the Science Committee, made appropriate reference to the death of the Society's consulting chemist, Dr A. P. Aitken, remarking upon the great loss sustained by the Society. He explained that the Directors had thought it advisable to delay for a little the filling up of the office of consulting chemist, and had arranged in the meantime to have analyses for members carried through by Mr J. W. Black, who had been Dr Aitken's chief assistant for several years. Referring to the work of the Science Department, it was stated that the manure and mutton experiments are still being continued at Sunderland Hall, Boon, and Naemoor. It was hoped that by the end of the current year these experiments might be found to be sufficiently advanced to admit of a report being published as to the results so far obtained. The Directors were gratified by the success which had last year attended the working of the Society's Milk Record Scheme, and were pleased to be able to have the scheme again in operation this year in the county of Ayr.

*Botanical Report.*

The following is Mr A. N. M'ALPINE'S report, which was read by the Secretary: "I have the honour to report that during the past season I have tested over 220 samples of grass and clover seeds. I would specially draw the attention of members to the fact that mixtures of seeds are not tested, and I do this because several mixtures have been sent to me for examination, with the request that I should separate the mixed ingredients and separately test their germinating power. I have examined several samples of red clover containing seeds of the parasite dodder (*Cuscuta trifolii*), and it will be interesting to observe whether outbreaks of dodder occur in those places where such seeds have been sown. I would notice further that several farmers are introducing into their mixtures such seeds as those of tall oat-grass, kidney vetch, chicory, and burnet. The burnet samples submitted to me have usually contained a considerable percentage of sainfoin.

The following table shows the maximum and minimum value of the samples, that is purity multiplied by germination:—

*Clovers.*

| Name of seed. | Maximum value per cent. | Minimum value per cent. | Hard, per cent |
|---|---|---|---|
| Red . . . . | 99 | 84 | 0 to 10 |
| White . | 95 | 70 | 2 to 21 |
| Alsyke . | 99 | 82 | 1 to 16 |
| Trefoil . | 99 | 70 | 0 to 5 |
| Kidney vetch | 95 | 90 | 2 to 5 |

*Grasses.*

| Name. | Maximum value per cent. | Minimum value per cent. |
|---|---|---|
| Perennial ryegrass . . . . | 98 | 85 |
| Italian ryegrass | 99 | 74 |
| Timothy . | 98 | 73 |
| Meadow fescue | 99 | 64 |
| Tall fescue | 73 | 68 |
| Hard fescue | 95 | 79 |
| Tall oat grass | 90 | 60 |
| Cocksfoot | 92 | 50 |
| Meadow foxtail | 78 | 64 |
| Crested dogstail | 96 | 71 |
| Smooth-stalked meadow grass | 80 | 40 |
| Rough-stalked meadow grass | 69 | 59 |

Mr SPEIR called attention to the efforts which the Society had made, along with the Royal Agricultural Society, to have reports on botany put before the public in similar terms. Formerly there was great difficulty in really knowing what was meant, as the same terms were not used by all botanists. This difficulty had now been largely got over, and this section of the Society's work was much more useful than formerly.

### NEW CHARTER AND NATIONAL DIPLOMA IN AGRICULTURE—PROFESSOR WALLACE'S ACCUSATIONS.

Dr GILLESPIE, on behalf of Lord Mansfield, read the report of the Committee appointed to consider Professor Wallace's accusations in reference to the application for the New Charter and the National Diploma in Agriculture. The report is as follows:—

"The Board of Directors, at their meeting on 6th April 1904, resolved, on the request of the Secretary of the Society, to appoint a Committee of their number to investigate certain accusations made against 'the Executive of the Society' by Professor Wallace of Edinburgh University in a printed letter dated 2nd April 1904, and circulated by him amongst the members of the Society.

"The Committee was appointed as follows: The Earl of Mansfield, Chairman of the Board of Directors, Sir James H. Gibson-Craig, Bart.; Mr Alex. M. Gordon of Newton; Dr Wilson of Carbeth; Dr Gillespie; Mr W. S. Ferguson; Mr Jonathan Middleton; Mr R. Shirra Gibb; Mr Alex. Cross.

"The Committee met in the Society's Chambers on Wednesday, 4th May. Apologies for absence were intimated from the Earl of Mansfield and Mr Gordon of Newton. The other members were present. Dr Gillespie was called to the chair.

"The following letter, addressed to the Chairman of the Committee by the Secretary of the Society, was read:—

"'*3rd May.*

"'SIR,—In reference to my request that a Committee should investigate the Circular issued by Professor Wallace to the members of the Society of date 2nd April, I beg to be permitted a word of explanation.

"'It is far from my wish to discourage fair criticism. Therefore, as regards all the contents of the Circular which the Committee regard as coming under that category, whether it be accurate or not or warranted or otherwise, I leave myself absolutely in the hands of the Committee, assuring them that I shall cordially assist them to the best of my power in whatever investigations, if any, they think proper to make.

"'But it seems to me that I am well justified in asking the judgment of my Directors as regards two matters dealt with in the Circular.

"'1. The second paragraph of the Circular imputes to me gravely improper conduct. Among other things it was said: "They ('the Executive') have acquired a wide but unenviable reputation for employing means by which ends are sought to be gained and objects accomplished, while salient facts within official knowledge are suppressed which the ordinary course of business and fair dealing between man and man demand should be made known." I respectfully ask the Committee to decide, after investigation, whether any fact or any instance justifies the imputations contained in that paragraph.

"'2. In paragraph 5 an accusation of a different kind is made—namely, that of having stated as fact that which was not true. The word "misrepresentation" is used, and the tenor of the paragraph suggests disingenuous dealing. I respectfully invite the Committee to decide, after investigation, as to the justification for each and all of the allegations and suggestions of the nature which I have mentioned.—I am, Sir, your obedient servant, JAMES MACDONALD,
*Secretary.*

"'The Chairman of the Committee appointed
to investigate Professor Wallace's Circular.'

"The Earl of Mansfield, as Chairman of the Board of Directors, had written to Professor Wallace, inviting him to attend that meeting and submit any observations he might desire to place before the Committee. The following reply from Professor Wallace was read:—

"'HOLM HILL, THORNHILL,
DUMFRIESSHIRE, *April* 25, 1904.

"'DEAR LORD MANSFIELD,

"'*Highland Society Methods Investigation Committee.*

"'In answer to your invitation, dated 22nd April, I shall be glad to attend the Committee Meeting on May 4th, at 2.15 P.M., but it is quite contrary to legal custom

to submit evidence to be led before a tribunal for the information of the opposite party before the event.

"'I hope you will excuse my declining to accept your dictum that I have made personal accusations against any individual as an individual. My case is that certain methods employed by the Highland Society Office or Executive, or whatever you may prefer to call it, at George IV. Bridge, are not creditable to a great national Society. I shall be prepared on the 4th to substantiate my statements, but under the peculiar position—viz., the Committee being composed of interested individuals, and presumably under the influence of those methods to which I take exception—I must insist on shorthand reporters being admitted to record an independent report of the proceedings. Should your Committee see fit to decline this, the only unprejudiced method of settling the matter, the public must be left to infer that the case will not bear thorough or public investigation. Under these conditions I leave the matter entirely in your Lordship's hands.—I am, yours faithfully,

"'ROBERT WALLACE.'

"Having deliberated, the Committee came to the unanimous conclusion that they could not take it upon themselves to admit representatives of the press to the meeting. The duty laid upon the Committee was simply to investigate and report to the Board of Directors. The question of publishing the proceedings, therefore, *did not rest with the Committee*, but with the Board of Directors.

"Professor Wallace having been invited into the meeting, and having had intimated to him the decision of the Committee as to the admission of representatives of the press, requested to be allowed to have present a shorthand writer employed by himself. He expressed his desire to be heard by the Committee only on his own conditions, which were that the shorthand writer referred to should be present to take a report of the proceedings, and that, after the Committee had made their report, he (Professor Wallace) should be at liberty to make what use he desired of his shorthand writer's report of the proceedings before the Committee.

"The Chairman again explained that it was not in the power of the Committee to enter into any arrangements as to the publication of their proceedings. He further stated that the Society's official shorthand writer would be present and would take a full report of the proceedings. Professor Wallace was not satisfied with this, stating that he would not rely on the accuracy of the official report.

"It was suggested to Professor Wallace that as his accusations against the Society's Executive were written and printed, the fairest course for him would be to submit in writing any explanations or observations he desired to lay before the Committee with regard to these accusations. Professor Wallace would not agree to this, and soon after left the meeting.

"It was resolved that the Secretary be instructed to communicate with Professor Wallace, offering him another opportunity of submitting in writing any statement he might desire to lay before the Committee in regard to the questions of fact which the Secretary specially wished the Committee to investigate.

"After further deliberation the meeting terminated, the Committee having decided to meet again on Wednesday, 1st June.

"The Committee met again on Wednesday, 1st June. All the members were present excepting Sir James H. Gibson-Craig, Bart., and Rev. Dr Gillespie. The chair was occupied by the Earl of Mansfield.

"The Secretary stated that, in accordance with instructions from last meeting, he had written to Professor Wallace, and had received a reply, dated 16th May 1904, which he now read. Professor Wallace would not submit any observations in writing, but enumerated conditions upon which he would be prepared to make verbal statements before the Committee. The Committee, being unable to entertain the conditions suggested by Professor Wallace, decided to proceed with their investigations.

"It was resolved that attention should be confined to the matters of fact specially adverted to in the Secretary's letter. Having carefully investigated these matters, the Committee now report upon them as follows:—

"1. The statement of Professor Wallace as to 'the Executive' suppressing salient facts which should have been made known is entirely unfounded.

"Every step which was taken by 'the Executive' in connection with the application for the New Charter was taken not only with the full knowledge and approval but by the specific instructions of the Board of Directors. Moreover, it is not the case that any facts which should have been made known were suppressed by any one.

"By desire of the Directors, detailed information was not only published in the Scottish newspapers at the time, but was also specifically communicated to the Government Departments charged with the merits of the question as regards the granting of the charter—viz., the Scotch Education Department and the Board of Agriculture. Moreover, the Chairman of the Board of Directors and the Secretary,

acting upon the instructions of the Directors, waited upon the Scotch Education Department to afford supplementary information and to give such explanations as the Department might desire.

"2. The paragraph in question here is the fifth in Professor Wallace's circular. It reads: 'Further, it is not true that I ever "interested myself" or "gave cordial support and assistance in the institution of the National Diploma in Agriculture." Special precautions were evidently taken that I should have no opportunity of doing so. Nor is this an ordinary misrepresentation; it is seriously aggravated by the fact that the Secretary of the Society made a similar statement at a meeting of Council on Education more than a year ago, and when called upon to substantiate it utterly failed to do so, but, on the contrary, produced documentary evidence which showed that the assertion was unfounded.'

"The Committee find that the official documents show conclusively—

"(a) That it is the case that Professor Wallace interested himself and gave support and assistance in the institution of the National Diploma in Agriculture.

"(b) That Professor Wallace's statement that precautions were taken that he should have no opportunity of interesting himself or assisting in the institution of the National Diploma in Agriculture is unfounded; on the contrary, the fact is that, in two capacities (as a member of the Council on Education and as a member of the Society's Board of Examiners) he was invited to—and did—interest himself and assist in the institution of the Diploma.

"(c) That the Secretary was correct in reminding Professor Wallace at the meeting of the Council on Education on 7th January 1903, that at the outset he (the Professor) had approved of the institution of the National Diploma in Agriculture, and had assisted in adjusting the Regulations.[1]

"The Committee have docketed the official papers, which have to a large extent formed the grounds of their report; they now place these papers on the table along with their report, and recommend that they lie in the Society's office for the inspection of any members of the Society who may at any time desire to see them.

"(Signed) MANSFIELD, *Chairman*.

"1st June 1904."

Dr Gillespie also read Professor Wallace's letter of 16th May 1904, and stated that the report of the Committee was submitted to the Board of Directors that day, when the following resolution was unanimously adopted: "The Board of Directors approve of and adopt the report, and desire to express regret that a man in the position of the Professor of Agriculture in the University of Edinburgh should have written and published a letter of the nature of that which has caused this investigation."

Mr George Prentice thoroughly understood the situation now, and was quite sure that, after the exposition given by Dr Gillespie, the members of the Society would be perfectly satisfied, and have no difficulty in adopting as theirs the resolution of the Directors. Although the Directors had not asked the meeting to express an opinion, yet he took the liberty of moving that they approve of the report and of the Directors' deliverance thereon.

Mr Constable seconded, and the motion was unanimously agreed to.

On the motion of Mr Gordon of Newton, a vote of thanks was accorded to the chairman.

## GENERAL MEETING IN THE SHOWYARD AT PERTH, 20th JULY 1904.

The usual general meeting of members of the Society was held in the Showyard pavilion. There was a crowded attendance, and the Earl of Mansfield, President of the Society, occupied the chair, having on his right the Earl of Onslow, Minister of Agriculture. Among others present were the Earl of Kinnoull, Lord Provost Love, the Rev. Dr Gillespie of Mouswald, Sir John Gilmour of Montrave, Sir Archibald Buchan-Hepburn of Smeaton, Sir Robert Moncreiffe of Moncreiffe, Sir Alexander Muir Mackenzie of Delvine, the Master of Polwarth, Mr A. M. Gordon of Newton, Mr Douglas Fletcher of Rosehaugh, Captain Clayhills Henderson of Invergowrie, Mr Macduff of Bonhard, Mr Gordon Duff of Drummuir, Banff; Mr M'Hutchen Dobbie,

[1] The Secretary explained to the Committee that he was under a misapprehension at that time in stating to Professor Wallace that part of the documentary evidence referred to was written by him (Professor Wallace); it was written *for* him, not *by* him—by Principal Wright *on behalf* of Professor Wallace, the late Dr Aitken, and himself.

Campend; Dr Wilson, Carbeth; Dr Shirra Gibb, Boon; Mr Duthie, Collynie; Mr Jonathan Middleton, Clay of Allan; Mr John M. Martin, Midcalder; Mr Andrew Hutcheson, Beechwood; Mr W. S. Ferguson, Pictstonhill; and Mr John Wilson, Edinburgh.

*Votes of Thanks.*

The Rev. Dr JOHN GILLESPIE proposed a vote of thanks to the Lord Provost, Magistrates, and Town Council of Perth. He said they of the Highland Society were greatly indebted to the Corporation of Perth for the cordiality of the reception which they had always given since the Highland Society met in that important centre.

Mr GORDON of Newton seconded the motion, which was adopted.

Lord Provost LOVE said that on behalf not only of the Corporation and the people of Perth, but also of a very large proportion of the people of Perthshire, he gave the Society a hearty welcome to the Fair City.

Sir ARCHIBALD BUCHAN-HEPBURN proposed that the thanks of the Society be given to the subscribers to the fund in aid of the Show, and to the donors of special prizes, for the liberal support they had given to the Society. The amount which had been given was £1108, 14s. 2d., which showed that the subscriptions had been on a very liberal scale.

Mr JONATHAN MIDDLETON, Clay of Allan, seconded the motion, which was adopted.

Mr WILLIAM DUTHIE, Collynie, proposed a vote of thanks to the local committee for their assistance in promoting the success of the Show.

Mr GORDON DUFF of Drummuir seconded, and the motion was adopted.

Mr FERGUSON, Pictstonhill, chairman of the local committee, in responding, said the feature of the committee was its enthusiasm. Every man of them felt that like members of a regiment success depended on individual effort.

The CHAIRMAN said he had to ask the meeting to give a very hearty welcome to his Majesty's Minister of Agriculture. Lord Onslow had been good enough to come from London to visit the Show, and would have to return that evening. His visit to the Show showed how much he appreciated the work that was done by them in Scotland, and it was accordingly their due to give him a hearty welcome.

*Speech by Lord Onslow.*

Lord ONSLOW said he had to thank the meeting most sincerely for their welcome. He could assure them that he had no greater pleasure than in performing a duty which he held to be that of every person holding his office, of making himself acquainted with agriculturists in all parts of the kingdom. Especially was it pleasant for him to come down to such a well-organised Show, with magnificent exhibits, in which the union of church and agriculture was so marked a feature. Above all, it was a pleasure to see how they were able to attract those who lived in the neighbourhood, whether they were agriculturists or not. Coming not very many weeks ago from the Show of the Royal Society in London, one could not help feeling that they had in a perambulating exhibition such as this an enormous advantage over one which was stationary. Such an exhibition, conducted on such lines, brought the best products of agriculture to the door of every farmer. He would not trespass at any length upon their attention, as he would have another opportunity of addressing an assemblage of Scottish agriculturists in Glasgow in October, under the auspices—he forgot exactly the technical name of the Society, but he always called it the Society for Heckling the Minister for Agriculture. He must congratulate them on the very prosperous season, compared at any rate with last year, which the farmers of this country were enjoying. He only hoped that prices would keep up—that as wool was going up, so other prices might increase, and that they might derive greater and greater reward from their labours and the investment of their capital. When he heard the Lord Provost talking about whisky, he reflected how great an advantage it must be that they were able to derive from the local taxation, or what they in England called the whisky money, so large a proportion for the purpose of technical education. He had seen part of the Show, and he hoped to see the rest of it that afternoon. He was quite certain that the Highland and Agricultural Society was one of the greatest bulwarks and props of agriculture in this country.

Sir JOHN GILMOUR proposed a vote of thanks to the President, the Earl of Mansfield, who had occupied the position as head of the Society not only in name but in deed and truth. He was a man upon whom they could rely, a man of whom Scotland was proud, and of whom Scotland would be prouder still.

The CHAIRMAN, in responding, said he was glad to know that the Show promised to be one of the most successful that the Society had ever held, and it was a satisfaction to him that he had been privileged to occupy the chair of the Society during the past year.

## ANNIVERSARY GENERAL MEETING, 11TH JANUARY 1905.

The Right Hon. the EARL OF MANSFIELD in the chair.

### *Honorary Members.*

The following were elected honorary members: Sir Henry Craik, K.C.B., late secretary, Scotch Education Department, London; Sir Thomas H. Elliott, secretary, Board of Agriculture, London.

### *New Members.*

One hundred and sixty-seven new members were elected.

### *Finance.*

Sir JOHN GILMOUR, in the absence of Sir James H. Gibson-Craig, honorary treasurer, laid on the table the volume of accounts for the year to 30th November 1904, as prepared by the Society's auditor. The outlays for the year amounted to £12,689, while the income, including £822 of life subscriptions, reached £14,333. The Perth Show left the handsome surplus of £1828. In connection with the promotion of agricultural education special grants were made during the year of £300 to the building fund of the Edinburgh and East of Scotland College of Agriculture, and of £100 for agricultural equipment for the Duchess of Sutherland's technical school at Golspie. The Society's grants to local shows and competitions exhibit a further increase, the amount for the past year being £637, as compared with £347 nine years ago.

### *Argyll Naval Fund.*

Mr GORDON DUFF submitted the accounts of the Argyll Naval Fund for 1903-4, which showed that the income for the year amounted to £222, 7s. 8d., while the expenditure was £200, in grants of £40 each to five naval cadets. One vacancy had occurred during the year in the list of beneficiaries by the promotion to the rank of lieutenant of Mr J. Douglas Campbell, grandson of the late Sir John Campbell of Airds, Argyllshire. From several well-qualified applicants, the Directors, on the recommendation of the Committee, nominated Mr John Stuart Binny Scott, son of the late Captain Scott, R.N., to the vacancy thus caused.

### *Perth Show,* 1904.

Mr W. S. FERGUSON reported upon the Show held at Perth in July 1904. The weather was, on the whole, favourable, and the attendance of the public was little or nothing short of the highest expectations. Not for many years has there been another display of farm live stock of equal merit in the Highland Show. Almost all the sections were well filled, and by most of the breeds a remarkably high standard of quality and character was attained. The collection of implements and machines was exceptionally large and of high excellence. The local authorities in town and county co-operated heartily with the Society, and as a result a bountiful measure of success attended the Show. By voluntary assessment the County Councils of Perth (Perth Show division), Forfar (western division), Fife, and Kinross raised a local fund of £1110 in aid of the Show. The receipts exceeded the expenditure by about £1828. Mr Ferguson added that he was proud indeed to be able to place before them such a very satisfactory report, and he was sure that when the time came round again, in eight years, for the Show to visit Perth, there would be no question as to whether it should do so or not.

### *Glasgow Show,* 1905.

Mr ALEX. CROSS reported that arrangements were well advanced for the Show to be held at Glasgow on Tuesday, 4th July 1905, and three following days. The Show will take place in the grounds of the Glasgow Agricultural Society at Scotstoun, in connection with which there are excellent railway and tramway facilities. He was glad to be able to say that all the counties in the district had now arranged to raise contributions to the local fund by means of voluntary assessments. A very liberal prize-list had been arranged, and a successful Show might be confidently looked forward to.

### *Border District Show,* 1906.

Mr JONATHAN MIDDLETON reported that the Show for 1906 fell to be held in the Border district, and the Directors had resolved that the Show will take place at

**Peebles. Peebles, he thought, had put its best foot foremost, and although it could not be said to be in the centre of the Border district, he thought it was quite suitable for the Show.**

*Edinburgh Show, 1907.*

Mr M'Hutchen Dobbie moved the resolution of the Board of Directors that the Show of 1907 be held in the Edinburgh district, provided satisfactory financial and other arrangements could be made.

The motion was seconded, and unanimously adopted.

*New Royal Charter and Agricultural Examinations.*

Dr Gillespie submitted the following resolutions on behalf of the Board of Directors: "(1) That the Council of the Highland and Agricultural Society of Scotland on Education, constituted and appointed in pursuance of the Society's Charter of 1856, be, and hereby is, suspended and discontinued until the Society shall otherwise resolve. (2) That the powers conferred by the Society's Charters of 1856 and 1904 of appointing a Board of Examiners, of conducting examinations, and of granting diplomas, and all the other powers conferred or confirmed by the third clause or section of the Society's Charter of 1904, in so far as it may from time to time appear to the Directors of the Society expedient to exercise these powers, or any of them, shall be exercised by the Society through the Directors of the Society, or through any Committee or Committees who may from time to time be appointed by these Directors for the purpose of exercising all or any of said powers. (3) That the following byelaws applicable to the Society's Charter of 1856 be, and hereby are, annulled and repealed—viz., That in terms of the Charter the Society shall nominate seven members to act on the Council of Education, that, in view of the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland having arranged to establish a joint-examination for a National Diploma in Agriculture, the Council be authorised to discontinue the Highland and Agricultural Society's examination in agriculture." He assumed he did not require to say anything in support of these new byelaws, except this, that while the old Council was proposed to be discontinued in the meantime, it was only right that he should propose the thanks of the Society to the gentlemen who had composed it, and especially to the official gentlemen in Edinburgh who had no direct connection with agriculture, but who had helped them greatly, and taken very deep interest in the scheme.

Mr Anderson seconded the motion.

The resolutions were agreed to.

*District Shows and Competitions.*

Mr J. M. Martin, in the absence of Mr A. M. Gordon of Newton, submitted the report on district shows and competitions, showing that in 1904 grants of money and medals have been given in 317 districts. The total expenditure under this head amounted to £637. For the current year the Directors proposed the following grants: (1) Under section one, twenty-three districts for grants of £12 each for cattle, horses, and sheep, and seventeen districts in intermediate competition with a grant of three silver medals to each. (2) Under section two, thirteen districts for grants of £15 each for stallions; special grants of £40 for Highland home industries, £25 towards joint show at Inverness; £20 for Kilmarnock Cheese Show; £5 to Shetland Agricultural Society, £3 each to Orkney, East Mainland, West Mainland, Sanday, Rousay, South Ronaldshay, and Birsay; two medals each to thirteen districts; about 150 medals at ploughing competitions; two medals each to eighteen districts for cottages and gardens—making the total sum offered in 1905, £678.

Agreed.

*Chemical and Botanical.*

**Dr R. Shirra Gibb reported on behalf of the Science Committee. He stated that the Society was still continuing the experiments at Sunderland Hall, Naemoor, and Boon, upon the influence of manures and cakes in the improvements of upland pastures, as estimated by the progress of sheep grazed on the land. These experiments had now gone on for four years, and it was intended that a preliminary report on the results of these years be published in the forthcoming volume of the 'Transactions.' The office of consulting chemist to the Society had been rendered vacant by the death of Dr A. P. Aitken, and the Directors, after giving the matter the fullest consideration, had appointed Mr James Hendrick, B.Sc., F.I.C., &c., chemist to the Aberdeen and North of Scotland College of Agriculture, to the vacant office, the conditions being practically the same as those which applied to the office at the time of Dr Aitken's death.**

Mr ALEX. GUILD, W.S., asked with whom lay the appointment of the consulting chemist? Was it with that meeting or with the Directors?

The CHAIRMAN said that that meeting had to homologate the appointment.

Mr GUILD asked whether, should the meeting disapprove of the action of the Directors in appointing Mr Hendrick, could they appoint any one they desired?

The CHAIRMAN—No.

Mr GUILD then moved that the meeting disapprove of the Report of the Chemical and Botanical Committee in so far as it referred to the appointment of Mr James Hendrick as consulting chemist to the Society. He had nothing to say against Mr Hendrick, but he thought that it should be an essential condition to the appointment that the gentleman receiving it should reside in the city of Edinburgh, and be readily accessible to the great body of members wanting to consult him. He thought it would be singularly unfortunate that each member should have to resort to Aberdeen before getting his manure analysed in terms of their rights as members. And, moreover, the opinion had got abroad—which, however, he was giving as second-hand—that this appointment had not been as carefully considered by the Directors or the members of the Committee as it should have been. It was said that a large majority of the Directors of the Society knew nothing of the appointment until they learned of it through the columns of an Aberdeen newspaper. If there was nothing in this rumour, and if their selection had been made by a departmental Committee of the Directors, he would remark that it was an office of paramount importance, and that the whole body of Directors should have brought their minds—their undivided minds—to bear upon the selection of the gentleman to be appointed. He begged to move his motion, and if in order, to add to it that the consulting chemist should be a resident of the city of Edinburgh. There were surely more than one chemist resident in Edinburgh qualified for the office. Why on earth they wandered to Aberdeen he could not tell.

Mr J. B. GLENDINNING, Ballencrieff, Drem, seconded the motion.

Dr GILLESPIE, in support of the action of the Directors, said that the place of residence of the man to be appointed had never been considéred. What the Directors wanted was to take the best man, wherever they could get him. Dr Anderson, who was long a most distinguished chemist and official of that Society, was resident in Glasgow, and in his humble opinion Glasgow was quite as important a place as Edinburgh. They were likely to get the samples analysed as quickly in Aberdeen as anywhere else, and the Board's policy had been to get the best man they could. The appointment was gone about most deliberately, with very anxious consideration on the part of the Board to do what was the very best for the Society. It was brought before the Directors more than once, and they were absolutely unanimous in the appointment; and it would be a very serious thing if that meeting gave a slap in the face to the Directors in the matter. The meeting at which the appointment was offered to Mr Hendrick by the Board was largely attended—as largely attended as most of the meetings were. When the scheme of local representation on the Board of Directors was instituted, it was predicted that the men from a distance would not attend. But that had not been fulfilled, as they found gentlemen from every part of Scotland—even from this despised place, Aberdeen—attending, and that most regularly.

The EARL OF HADDINGTON said that he was very glad that the speech which they had just heard had been brought before them, because, even before Dr Gillespie rose, he thought Mr Guild had cast an uncalled-for slur upon the Directors of the Highland Society in saying that the appointment of the chemist had not been duly considered by the whole of the Directors. He knew the Directors were a body of capable men, and he could not say more than that. The Directors were men in whom the Highland Society had confidence, and he thought that, before Mr Guild stated that any appointment had not been duly considered by the Directors, or by the Committee appointed by the Directors, he should be very careful of the statements he made.

Mr PRENTICE said that he could not understand Mr Guild's position. His arguments had been all dashed to the ground. In the first place, it had been proved that the Directors had taken extra trouble about this appointment, and it would be an exceptional thing if they had not done so, as he knew personally that they took the greatest amount of trouble about everything which came before them; and again, why should the appointment be given to an Edinburgh man? They could get men in Glasgow and elsewhere who could do the work as well as it could be done in Edinburgh. He cordially supported the action of the Directors.

The CHAIRMAN, before putting the amendment to the meeting, corroborated what had been said by Dr Gillespie, and assured them that this matter had received very serious consideration before a full Board. He would emphasise the fact that in a large meeting of Directors it was carried with absolute unanimity. The Directors, of course, were in their hands, and the meeting had the right of approving or disapproving of the appointment.

A VOICE—Have the Directors a right to vote on this motion?

The CHAIRMAN—We are here as members of this Society in general meeting assembled, and the Directors have the right to vote, and I, as Chairman, have both a deliberative and a casting vote.

A VOICE—I don't think that's fair.

A vote was then taken, and it resulted in the appointment of Mr Hendrick being confirmed by 75 votes to 64 for Mr Guild's amendment.

*Botanical Report.*

The Secretary read the following report by the Society's botanist, Prof. M'Alpine: I have the honour to report that during the past season I have examined over 260 samples of grass and clover seeds. The following table shows the maximum and minimum percentages (1) of germination, and (2) weed seeds present:—

| Name of sample. | Percentage of germination. | | Percentage of weed seeds present. | |
|---|---|---|---|---|
| | Max. | Min. | Max. | Min. |
| Red clover | 99 | 84 | 0 | |
| Alsyke clover | 99 | 82 | 0 | 3 |
| White clover | 97 | 70 | 0 | 3 |
| Trefoil clover | 99 | 70 | 0 | 1 |
| Perennial ryegrass | 98 | 70 | 0 | 5 |
| Italian ryegrass | 100 | 70 | 0 | 3 |
| Timothy ryegrass | 99 | 77 | 0 | 5 |
| Cocksfoot ryegrass | 94 | 50 | 0 | 5 |
| Meadow fescue | 99 | 60 | 0 | 2 |
| Tall fescue | 81 | 72 | 0 | 5 |
| Meadow foxtail | 85 | 60 | 3 | 8 |
| Hard fescue | 95 | 52 | 0 | 5 |

Among the red clovers many of the samples contained the seeds of the parasitic dodder. Several inquiries were sent to me asking whether the dodder seeds would grow in Scotland. I can now say from personal observation that the dodder seeds do grow in Scotland, and spread rapidly and extensively over the clover, but, so far as my observations go, the dodder plants in Scotland produce little or no seed capable of germination. The conclusion then is, that clover seed containing dodder ought not to be sown. With regard to foxtail, several samples reached me which contained the annual foxtail (*Alopecurus agrestis*), a worthless grass.

*Forestry.*

Sir ARCHIBALD B. HEPBURN moved that the annual grant of £50 to the lectureship on forestry in the University of Edinburgh be continued for the current year. He reported that the next examination for the Society's certificates in forestry would take place in the Society's Chambers on Tuesday, Wednesday, and Thursday, the 11th, 12th, and 13th of April, entries closing on 10th March

The motion was seconded and adopted.

*Education.*

Dr GILLESPIE reported the results of the examinations held at Reading and Kilmarnock last autumn for the National Diploma in Dairying. At Reading there were 23 candidates, of whom 16 obtained the diploma, at Kilmarnock 17 candidates, of whom 11 obtained the diploma. The names of the successful candidates at these examinations, as well as at the examination for the National Diploma in Agriculture held at Leeds last May, will be published in the forthcoming volume of 'Transactions.' He moved that the annual grant of £100 to Kilmarnock Dairy School be continued for the current year, and in doing so he remarked that he knew for a fact that pupils were attending the school from all over Scotland, and in considerable numbers from the North of Scotland.

The motion was seconded and agreed to.

*Publications.*

Dr GILLESPIE reported that the Publications Committee had completed arrangements for papers for the volume of 'Transactions' to be issued in the coming spring.

He hoped the members of the Society would find the volume interesting and useful to them. The revision and periodical printing of the list of the members of the Society came under the care of the Publications Committee, and he desired to take that opportunity of asking members to give the Committee and the officials of the Society their assistance in keeping the list up to date. Members can help greatly in this by intimating to the Secretary any errors or omissions they may discover in the printed list. In the course of the last two years (1903, 1904) the number of alterations on the Society's list of members was no fewer than 1144, equal to an alteration in one name out of every six in the entire list. He emphasised the fact that, by death and change of residence, many alterations took place in their list of members, and the members would confer a benefit, not only on themselves, but also on the officials, if they would take the trouble to look over the list and inform him of any changes which they detected.

A vote of thanks to the Chairman, proposed by Mr Alexander Glendinning, terminated the proceedings.

# APPENDIX

# PREMIUMS

OFFERED BY

# THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND IN 1905

## CONTENTS.

## GENERAL NOTICE.

THE HIGHLAND SOCIETY was instituted in the year 1784, and incorporated by Royal Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have since been continuously directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising the Society to grant Diplomas to Students of Agriculture; and by giving grants in aid of education in Agriculture and allied sciences. In 1900 the Society discontinued its own Examination, and instituted jointly with the Royal Agricultural Society of England an Examination for a National Diploma in Agriculture.

4. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practise. Terminated in 1881 in accordance with arrangements with the Royal College of Veterinary Surgeons.

5. The institution of a National Examination in Dairying, jointly with the Royal Agricultural Society of England

6. The institution of an Examination in Forestry for First and Second Class Certificates.

7. The appointment of a chemist for the purpose of promoting the application of science to agriculture, and to superintend local experiments.

8. The establishment of a Botanical Department.

9. The appointment of Entomologist to advise members regarding insect pests.

10. The annual publication of the 'Transactions,' comprehending papers by selected writers, Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.

11. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society), to assist young natives of the Highlands who enter His Majesty's Navy.

## CONSTITUTION AND MANAGEMENT.

The general business of THE HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of the Royal Charters, referred to above, which authorise the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers

The Supplementary Charter of 1856 provides for the appointment of a Council on Education, consisting of Sixteen Members — Nine nominated by the Charter, and Seven elected by the Society.

## PRIVILEGES OF MEMBERS

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. *To receive a free copy of the 'Transactions' annually.*
2. *To apply for District Premiums that may be offered.*
3. *To report Ploughing Matches for Medals that may be offered.*
4. *To Free Admission to the Shows of the Society.*
5. *To exhibit Live Stock and Implements at reduced rates.*[1]
6. *To have Manures and Feeding-Stuffs analysed at reduced fees.*
7. *To have Seeds tested at reduced fees.*
8. *To have Insect Pests and Diseases affecting Farm Crops inquired into.*
9. *To attend and vote at General Meetings of the Society.*
10. *To vote for the Election of Directors, &c., &c.*

## ANALYSIS OF MANURES AND FEEDING-STUFFS

The Fees of the Society's Chemist for Analyses made for Members of the Society shall, until further notice, be as follow:—

| | |
|---|---|
| The estimation of *one* ingredient in a manure or feeding-stuff . . . . | 5s. |
| The estimation of *two or more* ingredients in a manure or feeding-stuff . . . | 10s |

*These charges apply only to analyses made for the sole and private use of Members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.*

The Society's Chemist, if requested, also supplies valuations of manures, according to the Society's scale of units.

## SEEDS, CROP DISEASES, INSECT PESTS, &c.

The rates of charges for the examination of plants and seeds, crop diseases, insect pests, &c., will be had on application to the Secretary.

## ELECTION OF MEMBERS

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

## CONDITIONS OF MEMBERSHIP

The ordinary annual subscription is £1, 3s. 6d., and the ordinary subscription for life-membership is £12, 12s.; or after ten annual payments have been made, £7, 7s. Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, are admitted on a subscription of 10s. annually, which may be redeemed by one payment of £5, 5s., or, after ten annual payments have been made, by one payment of £3, 3s.[2] Subscriptions are payable on election, and afterwards annually in January.

Members are requested to send to the Secretary the names and addresses of Candidates they have to propose (stating whether the Candidates should be on the £1, 3s. 6d. or 10s. list).

JAMES MACDONALD, *Secretary.*

3 GEORGE IV. BRIDGE, EDINBURGH.

[1] Firms are not admitted as Members; but if one partner of a firm becomes a Member, the firm is allowed to exhibit at Members' rates

[2] Candidates claiming to be on the 10s. list must state under which of the above designations they are entitled to be placed on it.

# ESTABLISHMENT FOR 1904-1905

## President.

THE EARL OF EGLINTON AND WINTON, EGLINTON CASTLE, IRVINE.

## Vice-Presidents.

Sir JOHN STIRLING MAXWELL of Pollok, Bart., M.P., Pollokshaws.
Sir JOHN URE PRIMROSE, Bart., Lord Provost of Glasgow.
Colonel FREDERICK G. BLAIR of Blair, C.B., Dalry, Ayrshire.
CHARLES HOWATSON of Glenbuck, Glenbuck.

## Ordinary Directors.

| Year of Election. | |
|---|---|
| 1901 | ST CLAIR CUNNINGHAM, Hedderwick Hill, Dunbar. |
| | ALEXANDER CROSS of Knockdon, 19 Hope Street, Glasgow. |
| | A. H. ANDERSON, Kippendavie Estate Office, Dunblane. |
| | The EARL OF MANSFIELD, Scone Palace, Perth. |
| | CHARLES J. CUNNINGHAM, Wooden, Kelso. |
| | JOHN M'CAIG, Challoch, Leswalt, Stranraer. |
| | WILLIAM DUTHIE, Tarves, Aberdeenshire. |
| | JOHN CRAN, Kirkton, Bunchrew, Inverness. |
| 1902 | JAMES STENHOUSE, Turnhouse, Cramond Bridge. |
| | WILLIAM CLARK, Netherlea Farm, Cathcart. |
| | J. ERNEST KERR, Harviestoun Castle, Dollar. |
| | ANDREW HUTCHESON, Beechwood, Perth. |
| | E. DOUGLAS PATON, Broomhill, Melrose. |
| | Sir R. W. B. JARDINE of Castlemilk, Bart., Lockerbie. |
| | ALEXANDER M. GORDON of Newton, Insch, Aberdeenshire. |
| | J. DOUGLAS FLETCHER of Rosehaugh, Avoch, R.S.O., Ross-shire. |
| 1903 | R. SINCLAIR SCOTT, Burnside, Largs. |
| | Sir ROBERT D. MONCREIFFE of Moncreiffe, Bart., Bridge of Earn. |
| | JOHN MURRAY, Munnieston, Kippen Station, Stirling. |
| | Sir ARCHIBALD BUCHAN HEPBURN of Smeaton, Bart., Prestonkirk. |
| | JOHN MARR, Cairnbrogie, Old Meldrum. |
| | Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O. |
| | JONATHAN MIDDLETON, Clay of Allan, Fearn, Ross-shire. |
| | C. H. SCOTT PLUMMER of Sunderland Hall, Selkirk. |
| 1904 | JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith. |
| | WILLIAM TAYLOR, Park Mains, Renfrew. |
| | W. S. FERGUSON, Pictstonhill, Perth. |
| | DAVID WILSON, D.Sc., of Carbeth, Killearn. |
| | THOMAS GORDON DUFF of Drummuir, Keith. |
| | Colonel ROBERT F. DUDGEON of Cargen, Dumfries. |
| | JOHN MACPHERSON GRANT, Old Milton, Kingussie. |
| | H. M. LEADBETTER, Legerwood, Earlston. |

## Extraordinary Directors.

| | |
|---|---|
| 1904 | Sir CHARLES BINE RENSHAW of Barrochan, Bart., M.P., Houston.<br>Colonel R. K. STEWART, Murdostoun Castle, Newmains.<br>R. A. OSWALD of Auchencruive, Ayr.<br>JAMES CAMPBELL of Kilberry, Argyllshire.<br>J. WINDSOR STUART, Bute Estate Office, Rothesay.<br>J. HARLING TURNER, Portland Estate Office, Kilmarnock.<br>J. CAMPBELL MURRAY, Haggs Castle, Glasgow.<br>JOHN SPEIR, Newton Farm, Newton, Glasgow.<br>WALTER ELLIOT, Ardtornish, Morvern, R S.O., Argyllshire.<br>R. G. MURRAY, Spittal, Biggar. |
| 1902 | R. SHIRRA GIBB, Boon, Lauder.<br>JOHN M. MARTIN, Murieston House, Mid-Calder. |
| 1903 | C M. CAMERON, Balnakyle, Munlochy, Ross-shire.<br>ROBERT PATERSON, Hill of Drip, Stirling.<br>JOHN BALLINGALL, Dunbog, Newburgh, Fife. |
| 1904 | F. W. CHRISTIE, Dairsie Mains, Dairsie, R.S.O.<br>JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.<br>ANDREW RALSTON, Glamis.<br>JOHN M. AITKEN, Norwood, Lockerbie.<br>JAMES I. DAVIDSON, Saughton Mains, Corstorphine. |

## Office-Bearers.

Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., *Treasurer.*
Sir JOHN GILMOUR of Montrave, Bart., *Honorary Secretary.*
JAMES MACDONALD, F.R S.E., *Secretary.*
Rev. ARCHIBALD SCOTT, D D , *Chaplain.*
JAMES HENDRICK, B.Sc., F.I.C., Agricultural Department, Marischal College, Aberdeen, *Chemist.*
WILLIAM HOME COOK, C.A , 42 Castle Street, *Auditor.*
TODS, MURRAY, & JAMIESON, W.S., *Law Agents.*
A. N. M'ALPINE, 6 Blythswood Square, Glasgow, *Consulting Botanist*
R. S. MACDOUGALL, M.A., D.Sc., 13 Archibald Place, *Consulting Entomologist.*
JOHN MACDIARMID, *Clerk.*
EDWARD M. COWIE, *Second Clerk.*
WILLIAM BLACKWOOD & SONS, 45 George Street, *Printers and Publishers.*
KEITH & Co., 43 George Street, *Advertising Agents.*
G. WATERSTON & SONS, 35 George Street, *Stationers.*
THOMAS SMITH & SONS, 47 George Street, *Silversmiths.*
ALEXANDER KIRKWOOD & SON, 9 St James' Square, *Medallists.*
JOHN WATHERSTON & SONS, *Inspectors of Works.*
WILLIAM SIMPSON, *Messenger.*

## Chairman of Board of Directors.

The EARL OF MANSFIELD.

## Chairmen of Committees.

1. *Argyll Naval Fund* . . Captain G. D. CLAYHILLS HENDERSON.
2. *Finance, Chambers, and Law* Sir JAMES H. GIBSON-CRAIG, Bart.
3. *Publications* . . . . Very Rev. JOHN GILLESPIE, LL.D.
4. *Shows* . . . . . ALEX. M. GORDON.
5. *Science* . . . . . DAVID WILSON of Carbeth.
6. *General Purposes* . . Sir JAMES H. GIBSON-CRAIG, Bart.
7. *National Diplomas* . . Very Rev. JOHN GILLESPIE, LL.D.
8. *Forestry* . . . . The EARL OF MANSFIELD.

# COMMITTEES FOR 1904-1905

## 1. ARGYLL NAVAL FUND.

Capt. G. D. CLAYHILLS HENDERSON of Invergowrie, R.N., Dundee, *Convener*.
Sir DAVID BAIRD of Newbyth, Bart., Prestonkirk.
J. PATTEN MACDOUGALL, 39 Heriot Row, Edinburgh.
JOHN MACLACHLAN of Maclachlan, 48 Castle Street, Edinburgh.
R. SINCLAIR SCOTT, Burnside, Largs.

## 2. FINANCE, CHAMBERS, AND LAW.

Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., *Convener*.
The EARL OF MANSFIELD, Scone Palace, Perth
Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
ALEXANDER CROSS of Knockdon, 19 Hope Street, Glasgow.
A. M. GORDON of Newton, Insch, Aberdeenshire.
JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith.
W. S. FERGUSON, Pictstonhill, Perth.
JAS. I. DAVIDSON, Saughton Mains, Corstorphine.
DAVID WILSON of Carbeth, Killearn.
Sir JOHN GILMOUR of Montrave, Bart., Hon. Secretary *ex officio*.
WILLIAM HOME COOK, C.A., Auditor, *ex officio*.

## 3. PUBLICATIONS.

Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O., *Convener*.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
DAVID WILSON of Carbeth, Killearn.
R. SHIRRA GIBB, Boon, Lauder.
Sir ROBERT D. MONCREIFFE of Moncreiffe, Bart., Bridge of Earn.
JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith.
JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.

## 4. SHOWS.

ALEX. M. GORDON of Newton, Insch, Aberdeenshire, *Convener*.
JOHN M. MARTIN, Murieston House, Mid-Calder, *Vice-Convener*.
Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., Currie.
JOHN CRAN, Kirkton, Bunchrew, Inverness.
Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
Sir JOHN GILMOUR of Montrave, Bart., Leven.
JOHN MARR, Cairnbrogie, Old Meldrum.
JONATHAN MIDDLETON, Clay of Allan, Fearn.
R. SINCLAIR SCOTT, Burnside, Largs.

W. S. FERGUSON, Pictstonhill, Perth.
ALEX. CROSS of Knockdon, 19 Hope Street, Glasgow.
J. D. FLETCHER of Rosehaugh, Avoch, R.S.O., Ross-shire.
C. M. CAMERON, Balnakyle, Munlochy.
JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.
WILLIAM DUTHIE, Tarves, Aberdeenshire.
ROBERT F. DUDGEON of Cargen, Dumfries
JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith.
JOHN M'CAIG, Challoch, Leswalt.
Sir R. W. B. JARDINE of Castlemilk, Bart., Lockerbie.
WILLIAM CLARK, Netherlea Farm, Cathcart.
Sir ROBERT D. MONCREIFFE of Moncreiffe, Bart., Bridge of Earn.
JOHN MURRAY, Munnieston, Kippen Station, Stirling.
WILLIAM TAYLOR, Park Mains, Renfrew.
F. W. CHRISTIE, Dairsie Mains, Cupar-Fife.
A. H. ANDERSON, Kippendavie, Dunblane.
CHARLES HOWATSON of Glenbuck, Glenbuck.
ST CLAIR CUNNINGHAM, Hedderwick Hill, Dunbar.
CHARLES J. CUNNINGHAM, Wooden, Kelso.
JAMES STENHOUSE, Turnhouse, Cramond Bridge.
E. DOUGLAS PATON, Broomhill, Melrose.
J. ERNEST KERR, Harviestoun Castle, Dollar.
THOMAS GORDON DUFF of Drummuir, Keith.
ROBERT PATERSON, Hill of Drip, Stirling.
JOHN MACPHERSON GRANT, yr. of Ballindalloch, Old Milton, Kingussie.

## 5. SCIENCE.

DAVID WILSON of Carbeth, Killearn, *Convener.*
JONATHAN MIDDLETON, Clay of Allan, Fearn, Ross-shire, *Vice-Convener.*
The EARL OF MANSFIELD, Scone Palace, Perth.
R. SHIRRA GIBB, Boon, Lauder.
W. S. FERGUSON, Pictstonhill, Perth.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
ANDREW HUTCHESON, Beechwood, Perth.
ALEX. CROSS of Knockdon, 19 Hope Street, Glasgow.
Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O
JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.
Sir JOHN GILMOUR of Montrave, Bart., Leven, Fife.
JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith.
JOHN M'CAIG, Challoch, Leswalt.
C. H. SCOTT PLUMMER of Sunderland Hall, Selkirk.
JAMES STENHOUSE, Turnhouse, Cramond Bridge.
JOHN BALLINGALL, Dunbog, Newburgh, Fife.
THOMAS GORDON DUFF of Drummuir, Keith.
J. M. AITKEN, Norwood, Lockerbie.
JAMES HENDRICK, Chemist, *ex officio.*
A. N. M'ALPINE, Botanist, *ex officio.*

## 6. GENERAL PURPOSES.

Sir JAMES H. GIBSON-CRAIG of Riccarton, Bart., Currie, *Convener.*
The EARL OF MANSFIELD, Scone Palace, Perth.
G. R. GLENDINNING, Hatton Mains, Kirknewton.
ALEX. M. GORDON of Newton, Insch, Aberdeenshire.
Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
JOHN M. MARTIN, Murieston House, Mid-Calder.
JOHN M'HUTCHEN DOBBIE, Campend, Dalkeith.
Sir ARCHIBALD BUCHAN HEPBURN of Smeaton, Bart., Prestonkirk.
JOHN WILSON, Chapelhill, Lauder Road, Edinburgh.
Sir JOHN GILMOUR of Montrave, Bart., Leven, *ex officio.*

## 7. FORESTRY.

The EARL OF MANSFIELD, Scone Palace, Perth, *Convener*.
The MASTER OF POLWARTH, Humbie House, Upper Keith.
Sir JOHN GILMOUR of Montrave, Bart., Leven.
Sir ARCHIBALD BUCHAN HEPBURN of Smeaton, Bart., Prestonkirk.
A. M. GORDON of Newton, Insch, Aberdeenshire.
R. C. MUNRO FERGUSON of Raith, M.P., Kirkcaldy.
JOHN METHVEN, 15 Princes Street, Edinburgh.
Colonel F. BAILEY, 7 Drummond Place, Edinburgh.
DAVID KEIR, Ladywell, Dunkeld.
JOHN MICHIE, Balmoral, Ballater.
A. PITCAITHLEY, Jeanie Bank, Old Scone, Perth.

The President, Vice-Presidents, the Treasurer, Honorary Secretary, and Chairman of Directors are members *ex officiis* of all Committees.

# REPRESENTATIVES ON OTHER BODIES.

## National Agricultural Examination Board.

Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
ALEX. CROSS of Knockdon, 19 Hope Street, Glasgow.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
DAVID WILSON of Carbeth, Killearn.
The CHAIRMAN OF THE BOARD.
JAMES MACDONALD, *Secretary*.

## West of Scotland Agricultural College.

Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
JOHN M. MARTIN, Murieston House, Mid-Calder.

## Edinburgh and East of Scotland College of Agriculture.

R. SHIRRA GIBB, Boon, Lauder.
JAMES MACDONALD, *Secretary*.

## Aberdeen and North of Scotland College of Agriculture.

T. GORDON DUFF of Drummuir, Keith.
WILLIAM DUTHIE, Tarves.

# MEETINGS.

**General Meetings.**—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held in the months of January and June, in the Society's Hall, 3 George IV. Bridge, for the election of Members and other business. Twenty a quorum.

By a resolution of the General Meeting on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual

Show. This year it will be held at Glasgow, on Wednesday, 5th July, at an hour to be announced in the programme of the Show.

With reference to motions at General Meetings, Bye-Law No. 10 provides—"That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

**General Show at Glasgow**—4th, 5th, 6th, and 7th July.—Entries close for Implements, 1st May; Stock, Poultry, and Dairy Produce, 26th May.

**Directors' Meetings.**—The Board of Directors meet (except when otherwise arranged) on the first Wednesday of each month from November till June inclusive, at half-past one o'clock P.M., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Seven a quorum.

**Nomination of Directors.**—Meetings of Members, for the purpose of nominating Directors to represent the Show Districts on the Board for the year 1905-1906, will be held at the places and on the days after mentioned:—

| | |
|---|---|
| 1. Edinburgh, 3 George IV. Bridge, | Wednesday, 8th Feb., at 2. |
| 2. Glasgow, Royal Institution Rooms, | Wednesday, 15th Feb., at 1. |
| 3. Stirling, Golden Lion Hotel, | Thursday, 16th Feb., at 1.30. |
| 4. Dumfries, King's Arms Hotel, | Wednesday, 22nd Feb., at 1. |
| 5. Perth, Salutation Hotel, | Friday, 24th February, at 2. |
| 6. Kelso, Cross Keys Hotel, | Friday, 3rd March, at 12.30. |
| 7. Aberdeen, Imperial Hotel, | Friday, 10th March, at 2. |
| 8. Inverness, Station Hotel, | Tuesday, 14th March, at 12.30. |

The nomination of Proprietors or other Members paying the higher subscription must be made in the 1st, 2nd, 5th, and 6th Districts; and the nomination of Tenant-Farmers or other Members paying the lower subscription, in the 3rd, 4th, 7th, and 8th Districts.

**Committee Meetings.**—Meetings of the various Committees are held as required.

## EXAMINATIONS.

**Agriculture.**—The Examination for 1905 for the National Diploma in Agriculture will be held at the Yorkshire College, Leeds, on Monday, 8th May, and following days. Entries close on 31st March.

**Forestry.**—The Examination for the Society's Certificates in Forestry will be held on 11th, 12th, and 13th April 1905. Entries close on 10th March.

**Dairy.**—The Examination for 1905 for the National Diploma in Dairying will be held at the Kilmarnock Dairy School, on Monday, 25th September, and following days. Entries close on 31st August.

# AGRICULTURAL EDUCATION

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

From 1858 to 1899 the Society held an annual Examination for Certificate and Diploma in Agriculture, winners of the Diploma (F.H.A.S.) being elected Free Life Members of the Society.

In 1898 it was resolved by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland to discontinue the independent Examinations in Agriculture held by the two Societies, and to institute in their stead a Joint-Examination for a NATIONAL DIPLOMA IN AGRICULTURE (N.D.A.) This Examination is now conducted under the management of the "National Agricultural Examination Board" appointed by the two Societies. In the year 1903, on the invitation of the two Societies, the Board of Agriculture and the Scotch Education Department agreed to appoint a representative from each to act on the Examination Board. Dr Somerville represents the former and Mr John Struthers, C.B., the latter body. The following are the representatives appointed by the Highland and Agricultural Society for the current year, viz.:—

Very Rev. JOHN GILLESPIE, LL.D., Mouswald Manse, Ruthwell, R.S.O.
DAVID WILSON of Carbeth, Killearn.
ALEXANDER CROSS of Knockdon, 19 Hope Street, Glasgow.
JOHN SPEIR, Newton Farm, Newton, Glasgow.
THE CHAIRMAN OF BOARD OF DIRECTORS.
JAMES MACDONALD, *Secretary.*

## REGULATIONS AND SYLLABUS OF THE EXAMINATION FOR THE NATIONAL DIPLOMA IN THE SCIENCE AND PRACTICE OF AGRICULTURE.

### REGULATIONS.

1. The Societies may hold conjointly, under the management of the National Agricultural Examination Board appointed by them, an annual Examination in the Science and Practice of Agriculture, at a convenient centre.

2. Candidates who pass the Examination will receive the National Diploma in Agriculture—the Diploma to be distinguished shortly by the letters "N.D.A."

3. The Examination will be conducted by means of written papers and oral Examinations.

4. The Examination must be taken in Two Parts as follows:—

*First Part.*

1. Agricultural Botany.
2. Mensuration and Land Surveying (*or Agricultural Book-keeping*)
3. General Chemistry.
4. Geology.
5. Agricultural Zoology.

*Second Part.*

6. Practical Agriculture.
7. Agricultural Book-keeping (*or Mensuration and Land Surveying*).
8. Agricultural Chemistry.
9. Agricultural Engineering.
10. Veterinary Science.

Candidates have the option of taking Mensuration and Land Surveying in the First Part and Agricultural Book-keeping in the Second Part, or of taking Agricultural Book-keeping in the First Part and Mensuration and Land Surveying in the Second Part. The choice must be declared on the Entry Form at the time of Entry for the First Part.

5. The maximum number of marks obtainable and the minimum number of marks in each subject qualifying for the Diploma will be as follows:—

| Subject | Max No of Marks. | Pass Marks for Diploma. |
|---|---|---|
| *First Part—* | | |
| 1. Agricultural Botany | 200 | 120 |
| 2. Mensuration and Land Surveying | 200 | 120 |
| 3. General Chemistry | 200 | 120 |
| 4. Geology | 100 | 50 |
| 5. Agricultural Zoology | 100 | 50 |
| *Second Part—* | | |
| 6. Practical Agriculture | 500 | 300 |
| 7. Agricultural Book-keeping | 200 | 120 |
| 8. Agricultural Chemistry | 200 | 120 |
| 9. Agricultural Engineering | 200 | 120 |
| 10. Veterinary Science | 100 | 50 |

6. A Candidate who obtains not less than three-fourths (1500) of the aggregate maximum marks (2000) in the entire Examination will receive the Diploma with Honours, provided (*a*) that he passes each of the two Parts of the Examination at the first attempt, and (*b*) that he obtains not less than three-fourths (375) of the maximum marks (500) in the subject of Practical Agriculture.

7. A Gold Medal will be awarded to the Candidate on the Honours List who obtains the highest number of total marks in the whole Examination.

8. A Candidate will not be entitled to take both Parts of the Examination at one time. A year at least must elapse between the passing of the First Part and sitting for the Second Part; and the Second Part must, except with the special permission of the Board, be taken within two years of the passing of the First Part.

9. A non-returnable fee of £1 will be required from each Candidate for each Part of the Examination.

10. A Candidate who fails to obtain Pass marks in any of the subjects in the Part for which he is sitting must take the entire Part again.

11. Holders of the First Class Certificate of the Royal Agricultural Society of England and of the Diploma of the Highland and Agricultural Society of Scotland will not be eligible for this Examination.

12. The Board reserve the right to postpone, abandon, or in any way, or at any time, modify an Examination, and also to decline at any stage to admit any particular Candidate to the Examination.

The Sixth Examination for the National Diploma in Agriculture will take place in the Great Hall of the Yorkshire College, Leeds, on Monday, May 8, 1905, and following days. Forms of application for permission to sit at the Examination may be obtained in due course from either of the undersigned, and must be returned duly filled up not later than Friday, March 31, 1905, when the Entries will close.

By Order,

ERNEST CLARKE,
*Secretary, Royal Agricultural Society of England,*
13 Hanover Square, London, W.

JAMES MACDONALD,
*Secretary, Highland and Agricultural Society of Scotland,*
3 George IV. Bridge, Edinburgh.

*December* 1904

## SYLLABUS OF SUBJECTS OF EXAMINATION.

### *FIRST PART.*

### I.—AGRICULTURAL BOTANY.

1. *Morphology.*—The structure of plants. The principles of classification. The Natural Orders (Phanerogams and Cryptogams), dealing specially with those of importance to the Agriculturist.

2. *Physiology.*—The life of the plant. Organs and their functions—nutritive and reproductive.

3. *Pathology.*—Diseases of plants, and their causes. Parasites—Phanerogams, Fungi, Bacteria. Prevention and cure.

4. *Cultivation.*—Conditions in plant life favourable to (*a*) the improvements of cultivated plants, and (*b*) the destruction of weeds. New varieties of plants. Pastures. Pruning.

N.B.—*Candidates will be required to identify plants usually found on a farm.*

### II.—MENSURATION AND LAND SURVEYING.

1. Ordinary rules of superficial and solid mensuration. Volume of a prismoid. Applications to practical questions. Estimation of weights of bodies whose dimensions and specific gravity are known.

2. Land surveying by chain. Plotting from field-book, and determination of areas surveyed. The simpler "field problems."

3. The use and adjustment of instruments employed in Surveying and Levelling.

4. Levelling and plotting from field-book.

5. A sufficient knowledge of Trigonometrical Surveying for the determination of heights and distances by Theodolite; as essential to this, solution of plane triangles by the aid of Logarithmic Tables.

6. A knowledge of the various classes of maps published by the Ordnance Survey Department and their Scales.

N.B.—*Each candidate should have with him at the Examination a pair of compasses, scales of equal parts, including a scale of one chain to an inch, and the scale fitting the Ordnance map,* $\frac{1}{2500}$, *or* 25·344 *inches to the mile, a small protractor, a set square, and a straight-edge about* 18 *inches in length.*

## III.—GENERAL CHEMISTRY.

### CHEMICAL PHYSICS.

Matter and Energy—Pure and mixed matter—Methods of separating Mixtures—Simple and Compound substances—Kinetic and Potential energy—Transformation and Conservation of Energy.

The solid, liquid, and gaseous states of matter and the phenomena accompanying change of state.

Heat—the measurement of Heat—thermometers—calorimeter—the effects of Heat and pressure on Gases.

Gaseous diffusion—vapour tension—the barometer.

Mass and Weight—the balance—Specific Gravity—Density—Hydrometry.

Metric system of weights and measures.

### INORGANIC CHEMISTRY.

The chief elements found in the commonest forms of matter.

The atomic theory—molecular condition of matter—atomic and molecular weights

Chemical combination—symbolic notation—equations.

Hydrogen—its compounds with chlorine, oxygen, nitrogen, and carbon.

Oxygen—oxidation—combustion—respiration.

Water—natural waters—their impurities and purification.

Acids—bases—salts.

Carbon—its compounds with oxygen, sulphur, and nitrogen

Nitrogen—nitric acid—nitrates—and nitrites.

Sulphur—sulphides—sulphuric and sulphurous acids—sulphates.

Chlorine—Bromine—Iodine

Chlorides—Chlorates—chloride of lime, bleaching

Phosphorus—phosphates—superphosphate.

Silica—silicates—arsenic.

Metals—ores—general metallurgic processes

Alkalies—Chief Alkaline salts—Alkalimetry—Acidimetry.

Lime—the chief Lime compounds

Magnesium, Zinc, Iron, Lead, Copper, Mercury, Silver, and their technically important Salts

### ORGANIC CHEMISTRY

Distillation of Coal and Wood—Nature of chief products.

Hydrocarbons—Paraffins—Olefines and their chief oxidation products—Alcohols, Aldehydes, Acids.

Fermentations—Alcoholic, acetic, lactic, butyric.

Carbohydrates—sugars, starch, cellulose, dextrine, gums.

Fats—glycerol—saponification.

Benzene—Phenol.

Tartaric, Citric, and other common vegetable acids.

Amines and Amides—urea.

Proteids, Peptones, Gelatine, &c.

N.B.—*In this section exact knowledge of general principles and typical compounds is expected, rather than diffuse information.*

## IV.—GEOLOGY.

1. Chief minerals entering into the composition of rocks. Origin and composition of aqueous and igneous rocks. General principles of the classification of rocks. Leading divisions of the stratified rocks, and their geographical distribution in the British Islands.

2. Stratification, cleavage, and faulting of rocks.

3. Influence of the geological structure of a country on the configuration of the land and the composition of the soil. Relation of strata to water-supply and drainage. Origin of springs.

4. The various mineral manures, their sources, characters, and mode of occurrence.

5. Different kinds of building-stones and road materials. Distribution of the various economical substances.

N.B.—*Candidates will be required to name and describe common rocks, minerals, and fossils, and to show some knowledge of geological maps and sections.*

## V.—AGRICULTURAL ZOOLOGY.

1. The part played by common animals in helping or hindering agricultural operations, as illustrated by moles and voles, insectivorous and other birds, snails and slugs, useful and injurious insects, arachnids and myriopods, earthworms, &c.

2. *General Structure of Insects,* especially the external characters.

3. *Life-history of Insects.*—Various forms of larvæ. Economic importance of different stages.

4. *Classification of Insects.*—The general characters of the following Natural Orders: Coleoptera, Lepidoptera, Hymenoptera, Diptera, Hemiptera, Orthoptera, Neuroptera.

5. *Acarina* injurious to Food Crops and Live Stock.

6. *Parasitic Worms.*—Flukes, Tapeworms, and Threadworms.

7. *Preventive and Remedial measures* in regard to insects, acarines, and worm Parasites—*e.g.*, farm practice in relation to the discouragement of Insect Attack. Encouragement of insect-eating birds and mammals. Artificial remedies. Insecticides. Treatment for Parasites.

N.B.—*Practical acquaintance with common animals, especially insects and worm parasites, will be expected. Where the Candidate is not acquainted with the scientific name of an animal, the generally received English name will be accepted.*

## *SECOND PART.*

## VI.—PRACTICAL AGRICULTURE.

1. *Soils.*—Classification of soils—characters and composition—suitability for cultivation.

2. *Improvement of Soil.*—Drainage, Irrigation, and Warping. The application of lime—marl—clay—ashes, &c.

3. *Rotations.*—The principles of rotations—rotations suitable for different soils and climates—systems of farming.

4. *Manures.*—The properties of manures—general and special—amounts used per acre—period and mode of application—treatment and disposal of sewage.

5. *Food-stuffs.*—The properties of feeding substances—their suitability for different classes of farm stock—considerations affecting their use—rations for different classes of stock.

6. *Crops.*—Farm crops (cereals, agricultural grasses and clovers, forage plants and roots). How they grow—their cultivation, including cleaning, harvesting, and storage—diseases—insect injuries and remedies.

7. *Weeds and Parasitic Plants.*—Best methods of eradication.

8. *Pests of the Farm.*—Injuries to crops and live stock of the farm due to mammals, birds, and insects, with their prevention and remedies.

9. *Weather.*—Meteorology, or the effect of climate on farming conditions.

10. *Live Stock.*—The breeding, rearing, feeding, and general treatment of farm stock—the different breeds of horses, cattle, sheep, pigs, and poultry—their characteristics—the districts where they are generally met with.

11. *Milk.*—The production and treatment of milk—the manufacture of cheese, butter, &c.—the utilisation of bye-products.

12. *Machinery.*—The uses and prices of the machines and implements used in farming in different parts of Great Britain.

13. *Buildings.*—Buildings required on different classes of farms in various districts.

14. *Farming Capital.*—Calculations of the cost of stocking and working arable, stock, and dairy farms. Farm valuations. Rent, taxes, and cost of labour.

N B.—*It is essential that a Candidate know his subject practically, and that he satisfy the Examiner of his familiarity with farm routine. Candidates will be expected to illustrate their answers when necessary by intelligible sketches or diagrams.*

## VII.—AGRICULTURAL BOOK-KEEPING.

1. Agricultural Book-keeping—Description of books to be kept, with examples.
2. Valuation of stock and effects.
3 Profit and Loss, and Balance Sheet.

## VIII.—AGRICULTURAL CHEMISTRY.

1. *Soil.*—The origin, formation, and classification of soils. The constituents of soils. The supply of plant-food by the soil. The chemical and physical properties of soils of different kinds. The adaptation of soils to particular crops. The relations of air and water to soils. Nitrification and the biology of the soil. The chemical and physical effects of tillage operations and drainage. The improvement of soils. Causes of infertility. Mechanical and chemical analysis of soils.

2. *Plant-life*--The constituents of plants. The relations of atmosphere, rainfall, heat, and light to vegetation. The sources of plant-food.

3. *Manures.*—The supply of plant-food by manure. The improvement of the soil by manuring. The classification of manures as regards their composition, nature, and use. The manures in general use upon the farm. Farmyard manure and other natural manures. Green-manuring. Liming, marling, claying Artificial manures, their origin and manufacture. The changes which manures undergo in the soil. The influence of drainage. The application of manures. The analysis of manures. The adulteration of manures.

4. *Crops.*—The composition of the principal farm crops. Characteristics of particular kinds of crops. The influence of climate and season. The manuring of particular crops. The changes that take place in crops during the various stages of their growth. Rotation of crops.

5. *Foods.*—The constituents of foods, and their functions. The nutritive value and digestibility of foods. The chemical composition and use of the principal feeding-stuffs employed on the farm, and the sources of their supply. The main facts regarding respiration and digestion. The relation of foods to the production of work, meat, milk, and manure. The adaptation of foods to special requirements. The residual manurial value of foods, and the circumstances affecting it. The estimation of unexhausted fertility. Analysis and adulteration of foods.

6. *Water.*—Rain-water. Hard and soft waters. Drinking waters. Irrigation and sewage.

7. *Dairying.*—The composition of milk, and the conditions which influence its quality and supply. Cream and cream-separation. Butter and butter-making. Cheese and cheese-making. The influence of ferments on milk and milk products. The preservation of milk. Milk-testing.

## IX.—AGRICULTURAL ENGINEERING.

1. *Heat.*—Specific heat; latent heat; the unit of heat. Total heat of water; as ice, water, and steam. Conduction, convection, and radiation of heat. Mechanical equivalent of heat. Principle of combustion. Quantity of heat generated by combustion. Modes of transforming heat of combustion into power, as in the steam-engine, and in gas and oil engines.

2. *Air.*—Properties of air; elasticity, density. Barometer. Moisture. Movement. Winds. Windmills.

3. *Water.*—Composition, impurities, weight. Height of column to balance atmosphere. Flow of water. Friction of water in pipes and channels. Usual speed of flow. Power derived from falls of water. Water-wheels; turbines; water-pressure engines; pumps. Potable water. Sources of supply. Means of purification. Storage.

4. *Mechanics.*—Centre of gravity; stability of structures. The lever; toothed wheels; pulleys and ropes; wrapping connectors; winches; differential pulleys. Laws of motion. Strength of materials, tensile, compressive, torsional, and transverse; elastic limit; ultimate strength. Horse-power; animal and human power. Friction of surfaces and axles; lubrication.

5. *Steam-engine.*—Construction of an ordinary portable-engine boiler, and of a Cornish boiler, and its setting. Fittings of a boiler. Construction of the stationary and portable steam-engine. Single cylinder. Double cylinder. Compound. Steam and fuel consumed per horse-power.

6. *Gas and Petroleum Engines.*—Principle of action. Sources of loss. Fuel and water required per horse-power.

7. *Electrical Generators, Motors, and Conductors.*—Principles of action. Losses in electrical machinery. Efficiency. Detection of faults. Use of fuses and cut-outs. Horse-power of motors. Ohm's law.

8. *Construction of Agricultural Implements.*—The mode of action and the general principles involved in the construction of farm implements. The adjustments of implements for different descriptions of work. Lubrication. Working or wearing parts.

9. *Cultivating Implements worked by Steam Power.*

10. *Horse-cultivating Implements.*—Ploughs. Cultivators or Grubbers. Harrows. Rollers. Scrubbers, &c.

11. *Sowing Implements.*—Drills. Manure and water drills. Broadcast barrows. Broadcasters. Manure distributors. Potato planters, &c.

12. *Hoeing Implements.*—Horse-hoes. Scufflers.

13. *Securing of Crops.*—Reaping machines. Mowing machines. Haymakers. Horse-rakes. Elevators. Silage appliances. Potato raisers, &c.

14. *Carriages.*—Carts. Waggons. Motor Waggons. Sleighs. Rick-lifters, &c.

15. *Preparing Crops for Market.*—Threshing machines. Winnowing machines. Corn screens. Hummellers. Hay and straw presses, &c.

16. *Preparing Foods.*—Mills. Chaff-cutters. Pulpers. Turnip-cutters. Cake-breakers. Cooking apparatus.

17. *Dairy Appliances.*—Cream separators. Churns. Butter-workers. Cheese tubs. Curd mills. Cheese presses. Setting-pans. Refrigerators, &c.

18. *Land Improvement.*—Drainage instruments. Limekilns. Arrangements of shafting, pulleys, clutches, &c., for farm machinery at homesteads. Building construction and material.

N.B.—*Marks will be given for neatness and accuracy of Drawing.*

## X.—VETERINARY SCIENCE.

1. Anatomy and Physiology, including the comparative anatomy of the bones of the animals of the farm, and the structure and functions of the different organs and tissues of the horse, ox, sheep, and pig.
2. The digestive processes and principles of nutrition in the above animals.
3. A general knowledge of the blood and its circulation, and the processes of respiration, secretion, and excretion.
4. The physiology of reproduction, and its bearings on healthy breeding.
5. The period of gestation in the mare, cow, ewe, and sow, and the special management of these animals prior to, at the time of, and after parturition.
6. The management of farm stock in health and disease.

The following have won the Diploma :—

### 1900.

George Potts, Durham College of Science, Newcastle-on-Tyne (Gold Medal and Diploma with Honours).
John Lawrence Schneider, South-Eastern Agricultural College, Wye, Kent.
Kenworthy James Thompson, University College of Wales, Aberystwyth.
John Roberts, University College of Wales, Aberystwyth.
Selwyn Eld Durant, South-Eastern Agricultural College, Wye, Kent.
Samuel Simpson, Harris Institute, Preston, and University, Edinburgh.
Ernest Christopher Brown, Yorkshire College, Leeds.

### 1901.

Albert William Oldershaw, Midland Agricultural and Dairy Institute, Kingston, Derby.
John Montgomerie Hattrick, West of Scotland Agricultural College, Glasgow.
Bernard William Bull, Ramsden, Billericay, Essex
Simon Blore, University College of Wales, Aberystwyth.
Thomas Young, West of Scotland Agricultural College, Glasgow.

### 1902.

Patrick Fowlie, The Agricultural College, Aspatria, and Yorkshire College, Leeds.
Thomas Milburn, Harris Institute, Preston.
William Maitland Findlay, Agricultural Department, The University, Aberdeen.
John Percival, Harris Institute, Preston, and Harper-Adams Agricultural College, Newport, Salop.
Edward Porter, Harris Institute, Preston, and West of Scotland Agricultural College, Glasgow.
John Edwin Rigg, Harris Institute, Preston.

Abel Edwin Jones, University College of North Wales, Bangor, and University College of Wales, Aberystwyth.
James Bradshaw, Harris Institute, Preston, and West of Scotland Agricultural College, Glasgow.
John Forrest, Harris Institute, Preston.
Geoffrey Steele Henderson, West of Scotland Agricultural College, Glasgow.

1903.

William Benson Thompson, Yorkshire College, Leeds (Gold Medal and Diploma with Honours).
Andrew Steedman, Royal College of Science, Dublin.
William Thomas Stockley, Harris Institute, Preston.
John Porter, West of Scotland Agricultural College, Glasgow.
James Wood Thompson, Harris Institute, Preston.
William James Megaw, The University, Edinburgh.
Henry Brougham Hutchinson, Harris Institute, Preston.
Herbert Bowman Beddall, Royal Agricultural College, Cirencester.
John Henry J. Farquhar, Durham College of Science, Newcastle.
Samuel Alker, Harris Institute, Preston.
John Bateson, Harris Institute, Preston.
John Ellis, University College of Wales, Aberystwyth.

1904.

Henry Gordon Hird, Yorkshire College, Leeds (Gold Medal and Diploma with Honours).
John Struthers, West of Scotland Agricultural College, Glasgow.
Robert Charles Andrew, Harper-Adams Agricultural College, Newport, Salop.
Percy Hutchinson Lamb, Yorkshire College, Leeds.
Robert Edward Severs, Yorkshire College, Leeds.
Robert Charles Gaut, Yorkshire College, Leeds.
Joseph Black, Yorkshire College, Leeds.
Roger Prosser, University College of Wales, Aberystwyth, and The University, Edinburgh.
Edward Bertram Osborne, Yorkshire College, Leeds.
Francis Howard Billington, Yorkshire College, Leeds.
William Frank Craske, South-Eastern Agricultural College, Wye.
James Kendall Earle, Yorkshire College, Leeds.
John Edward Bridges, Yorkshire College, Leeds.
John Earle, Yorkshire College, Leeds.
John Miller Lonsdale, Harris Institute, Preston.
Thomas Wibberley, Harris Institute, Preston.
Charles Anthony Williams, University College of Wales, Aberystwyth.
James Guthrie Stewart, The University, Aberdeen.
Samuel Gilbert Isitt, Harper-Adams Agricultural College, Newport, Salop.
David Jones, University College of Wales, Aberystwyth.

Past Examination Papers.

Copies of the Papers set at the Examinations in 1900, 1901, 1902, 1903, and 1904 may be had on application. Price 6d. per set.

# VETERINARY DEPARTMENT

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become Members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of Students who passed for the Society's Certificate is 1183.

The Society votes annually eleven silver medals for Class Competition to each of the two Veterinary Colleges in Edinburgh, and to the one in Glasgow.

---

# FORESTRY DEPARTMENT

The Society grants First and Second Class Certificates in Forestry.

In 1900 it was resolved that the examination in Forestry be held in 1901, and thereafter every alternate year.

Candidates must possess—1. A thorough acquaintance with the theory and practice of Forestry. 2. A general knowledge of the following branches of study, so far as these apply to Forestry: The Elements of Botany; The Elements of Physics, Chemistry, and Meteorology; Forest Entomology; Forest Engineering, including Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to fencing, draining, bridging, road-making, and saw-mills; Implements of Forestry; Book-keeping and Accounts.

The examinations[1] are open to candidates of any age, will be both written and oral, and will include such practical tests as may from time to time be found convenient to apply.

The maximum number of marks for each subject is 100; First-Class marks in all subjects 75, Second-Class marks in all subjects 50, Pass marks in all subjects 40.

To obtain the *First-Class Certificate* a Candidate must have First-Class marks in Forestry and any two of the other subjects, and Pass in the two remaining subjects. To obtain the *Second-Class Certificate* a Candidate must obtain Second-Class marks in Forestry and in any two of the other subjects, and Pass in the two remaining subjects.

If a Candidate has obtained First-Class marks in Forestry and failed to obtain First-Class marks in only one or two of the other subjects, he can come up again for examination in these subjects alone for the *First-Class Certificate*, otherwise he must go through the entire examination again.

The list of students who obtained Certificates prior to 1899 appears in the 'Transactions,' Fifth Series, vol. xi. (1899).

The following have since obtained First-Class Certificates:—

| | |
|---|---|
| Eric Arthur Nobbs, Edinburgh, . . . . . . | 1899 |
| George Potts, Whitchurworth, Trimdon Grange, Durham, | 1899 |
| Duncan S. Rabagliati, 1 St Paul's Road, Bradford, . | 1901 |
| Frank Scott, Dumfries House Mains, Cumnock, . . | 1903 |

[1] The Examination will be held this year on the 11th, 12th, and 13th April.

The following have since obtained Second-Class Certificates :—

| | |
|---|---|
| WILLIAM BRUCE, Buxton Cottage, Laurencekirk, . . | 1901 |
| RAJAPPIER SWAMINATHAN, 56 Jesus Lane, Cambridge, . | 1901 |
| THOMAS USHER, Courthill, Hawick, . . . . . . | 1901 |
| ALEXANDER MITCHELL, Braidwood, Gorebridge, . . | 1903 |

---

# SYLLABUS OF EXAMINATION

## I.—SCIENCE OF FORESTRY AND PRACTICAL MANAGEMENT OF WOODS.

I. *Principles of Scientific Forestry.*—1. Effects of heat, light, moisture, and air-currents on forest vegetation. 2. Effects of depth, porosity, moisture, and chemical composition of the soil on forest vegetation. 3. Effects of forest vegetation on the soil and air. 4. Rate and extent of development, longevity, and reproductive power of trees. 5. Pure and mixed woods. 6. Systems of sylviculture.

II. *Practical Management of Woods.*—7. Draining and irrigation. 8. Choice of species for various situations. 9. Seed and sowing, including nurseries. 10. Planting. 11. Natural regeneration by seed, shoots, and suckers. 12. Formation of mixed woods. 13. Tending of young woods. 14. Pruning. 15. Thinning. 16. Sylvicultural characteristics of the principal trees.

III. *Injuries by Storms and Fires.*—17. Storms. 18. Fires.

IV. *Timber.*—19. Its technical properties. 20. Its defects. 21. Recognition of different kinds of timber. 22. Processes for increasing its durability.

V. *Utilisation of Produce.*—23. Uses of wood and other produce. 24. Felling. 25. Conversion. 26. Seasoning. 27. Transport. 28. Sales. 29. Harvesting of bark.

VI. *Forest Organisation.*—30. General ideas regarding a regulated system of forest management.

## II.—FOREST BOTANY AND FOREST ZOOLOGY.

### (*a*) FOREST BOTANY.

The fundamental facts of morphology, physiology, and classification of plants. The structure and function of the plant-cell and the plant-tissues. Their primary distribution. The secondary changes they exhibit in consequence of perennation.

The structure and function of the root and shoot in flowering-plants. Buds, their forms and uses. The flower. The fruit. The seed.

The structure and function of vegetative and reproductive organs of fungi.

Relationship of plants to air, soil, and water. Effect of light, heat, and mechanical agencies upon plants. Nutrition. The nature and elements of the food of plants. Sources of plant-food. The absorption,

elaboration, transference, and storage of food. Respiration and transpiration. Parasites and saprophytes. Symbiosis.

Growth of plants in length and thickness. Correlation of growth, pruning. Germination of seeds. Formation of wood and bark. Healing of wounds.

Diseases of plants due to faulty nutrition and unfavourable circumstances of growth. Diseases due to attacks of fungi.

Natural reproduction and propagation by seeds and by buds. Fertilisation of flowers. Hybridisation. Artificial propagation by budding, grafting, layering, and cutting.

The characters of the large groups and classes of the vegetable kingdom. The characters of the families of plants which include the chief timber trees. The botanical characteristics of the principal British forest-trees (including the structural features of their wood). The weeds of the forest and their significance.

### (b) Forest Zoology.

The group Insecta: its position in the animal kingdom. Structure, mode of reproduction, and metamorphosis of insects. The outlines of classification of the group. Conditions favourable to the numerical increase of insects. Natural checks to increase (*e.g.*, birds, mammals, parasitic insects). The identification and life-history of the more important insects injurious to forest-trees and fruit-trees. The damage caused by these insect pests and their mode of attack. The damage caused by animals. Preventive and remedial measures.

## III.—PHYSICS, CHEMISTRY, AND METEOROLOGY.

*Physics.*

Mass, weight, specific gravity, solid, liquid, and gaseous states of matter. Capillarity, osmose, vapour tension, suction pump, force pump, syphon, barometer, atmospheric pressure. Boyle's law. Levers and pulleys. Heat, measurement of heat, specific heat; transference of heat by conduction, convection, and radiation. Boiling and freezing. Latent heat. The thermometer. The conservation and transformation of energy. Light—reflection, refraction, polarisation; the spectrum. The rudiments of electricity and magnetism.

*Chemistry.*

Elements. Oxygen, hydrogen, nitrogen,—their preparation, properties, and chief compounds. Acids, bases, salts. Combustion, oxidation, reduction. Sulphur, Carbon, Phosphorus; and their compounds, with oxygen and hydrogen. Metals—potassium, sodium, calcium, magnesium, aluminium, iron, copper, lead, mercury, and their chief compounds. Carbohydrates, marsh gas, olefiant gas, alcohol, acetic acid, oxalic acid. Distillation of wood and coal.

*Meteorology.*

The atmosphere, its composition and physical properties. Measurement of pressure and temperature. The barometer. Rain, hail, snow, fog, cloud, dew, the dew point, hoar frost. The weathering of rocks and soils. Gases injurious to vegetation.

## IV.—FOREST ENGINEERING, INCLUDING LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, BRIDGING, ROAD-MAKING, AND SAW-MILLS.

1. The use of the level and measuring-chain. Measuring and mapping surface areas. 2. The measurement of solid bodies—as timber, stacked bark, fagots, &c., earthwork. 3. The different modes of fencing and enclosing plantations; their relative advantages, durability, cost of construction, and repairs. 4. The setting out and formation of roads for temporary or permanent use. 5. The construction of bridges over streams and gullies; of gates or other entrances. 6. The construction and working of estate saw-mills.

## V.—BOOK-KEEPING AND ACCOUNTS.

1. Questions in Practice, Proportion, and Decimal Fractions. 2. Book-keeping—describe books to be kept; and best method of valuing timber. 3. Practical questions in Book-keeping will also be given.

# EXAMINATION PAPERS, 1903[1]

## PRACTICAL FORESTRY.

1. In a plantation about 120 years of age, the crop consists of hardwoods, with patches of larch, Scots fir, and spruce. The hardwoods are healthy but the other varieties of trees show signs of decay. To what causes of decay are these trees most liable? Explain the best method of dealing with the plantation.

Adjoining the plantation is a piece of new ground, 10 acres in extent, which is proposed to be embraced with the plantation. It is to be planted with a mixture of one-third larch, one-third Scots fir, and one-third hardwoods (oak, beech, elm, and ash). Mention how many trees should be planted per acre, the size of the plants to be used, the price per 1000 of each variety, and the cost of planting.

2. A proprietor is about to enclose for planting purposes a square piece of ground 50 acres in extent. Explain how this is to be fenced with wire and larch posts, describing how the straining and other posts are to be secured in the ground, mentioning the dimensions of the posts, the number and gauge of the wire, and the distances between each wire. State the price of the posts and of the wire, and the cost of erection per yard, and calculate the cost of the total length of fence.

3. Explain when a first thinning should take place in a young plantation of Scots fir and larch which has grown fairly well. When planted the trees were placed 3½ feet apart. Mention the approximate number of trees per acre that would be taken out and the probable number left standing on the ground. When would the next thinning be likely to take place? What value might be expected from each thinning? What would you estimate as the value of the crop if allowed to grow till it was fifty years of age?

[1] No Examination in 1904.

4. I am anxious to have a sale of timber, and wish you to explain how to set about it. One plantation, sixty years of age, having a crop of conifers of 300 trees per acre, is to be thinned; and another plantation, containing hardwoods and a general mixture of conifers, is at maturity and must be cleared. Explain how you would mark and classify both divisions, how best to dispose of the trees, what conditions of sale you would draw up, and how you would afterwards treat the ground for replanting.

5. In regard to the conversion of timber, describe briefly (1) the details of a simple saw-mill, (2) the motive power required to suit varying circumstances, (3) the mode of transport of timber to and from the saw-mill, (4) the seasoning of timber by (*a*) natural and (*b*) artificial means.

6. State what are the causes and effects of defects in timber such as ring-shake, star-shake, heart-rot, red-rot, blue-wood, and loose and black knots.

7. State what you consider should be the normal weight of timber in the green state and air-dried, (1) Conifers, (2) Hardwoods, and (3) Softwoods, such as willow, poplar, lime, &c.

(*Two hours allowed.*)

## FOREST BOTANY AND FOREST ENTOMOLOGY.

(*Candidates are expected to answer* **five** *of the questions*—**three** *from the Section of Forest Botany, and* **two** *from the Section of Forest Entomology*)

### (*A*) FOREST BOTANY.

1. Describe leaf-fall. What is the advantage to the plant of the process?

2. Write an account of the life-history of any parasitic fungus harmful to a forest-tree. What methods of prevention and of remedy would you adopt in relation to the fungus you describe?

3. Describe the seed of oak, ash, elm, larch, maple, elder, hawthorn. What do you know of the duration of vitality and of the length of period of germination of these seeds?

4. What is the structure and function of a medullary ray? Describe the condition of a medullary ray in winter and in summer.

5. Describe the mechanism for pollination in the flowers of any three forest trees of different genera

### (*B*) FOREST ENTOMOLOGY.

6. Describe Hylobius abietis, the Pine Weevil, under the following heads:—

(*a*) The weevil itself and how it is recognised.
(*b*) Its life-history.
(*c*) What plants are attacked, when, and how?
(*d*) Preventive and remedial measures.

7. Give a detailed year's life of the Spruce Gall Aphis or the Woolly Aphis, noting the direct and indirect harm done to the tree attacked, and measures of prevention and remedy.

8. Name two Lepidopterous, or two Hymenopterous, caterpillars destructive to forest trees. How would you—

(*a*) Recognise them?
(*b*) Recognise their work?
(*c*) Fight them?

(*Two hours allowed.*)

## PHYSICS, CHEMISTRY, METEOROLOGY.

1. How would you determine the specific gravity of a piece of stone and a piece of wood respectively?

2. Given a piece of wood, a piece of limestone, and some water, how from these would you make caustic potash?

3. What are the chief products obtained from the destructive distillation of wood? How would you make pure acetic acid from them?

4. Describe the construction of the mercürial barometer, and explain what is directly, and also inferentially, indicated by a fall in the mercurial column.

(*An hour and a half allowed.*)

## LAND MEASURING, &c.

1. Calculate the contents of an area of ground, the two sides of which are parallel and measure 600 and 450 feet respectively, the uniform breadth being 180 feet, and give the result: 1st, in square yards; 2nd, in Imperial measure—acres, roods, and poles; and 3rd, in Scots measure—acres, poles, and falls.

2. Calculate the contents of a triangular piece of land measuring 300 feet along the base and 160 feet perpendicular from the base to the apex, in square yards.

3. Calculate the contents of a circle measuring 3 chains radius, and give the result in acres, roods, and poles.

4. Calculate the contents of a piece of earth-cutting for the formation of a roadway 30 feet wide, measuring 300 feet in length, 12 feet in depth at one end and 6 feet in depth at the other end, and to have side slopes of $1\frac{1}{2}$ horizontal to 1 perpendicular, in cubic yards.

5. What are the points to be attended to in the proper construction of an estate road 18 feet wide?

6. Give sketch of a bridge to be constructed of estate material over a burn for the above road.

7. State the various forms of wheel for utilising water-power for driving the machinery of a saw-mill, and which gives the most power.

(*Two hours allowed.*)

## ARITHMETIC AND BOOK-KEEPING.

1. Simplify $(\frac{1}{26} \text{ of } 3\frac{1}{4}) + (\frac{3}{8} \div \frac{27}{64}) - \left(\frac{1}{1\frac{1}{7}} - \frac{1\frac{1}{3}}{3}\right) \div (2 - \frac{5}{9})$.

2. Find by Practice the rent of 23 acres 3 roods 5 poles, at £3, 18s. 9d. per acre.

3. Express 3 roods 27 poles 11 yards in decimals of an acre.

4. If the carriage of 3 tons of timber cost £5 for 40 miles, how much ought to be carried for the same price for 25¾ miles? Give the answer in decimals of a ton correct to 2 places.

5. Find the weight of a rectangular pile of larch boards 7 feet high 15 yards long and 4 yards wide, assuming that the boards weigh 40 lbs. per cubic foot. The pile consists of 6048 boards 12 feet long by 10 inches wide. Of what thickness are these boards?

6 Give a specimen page of the Private Sales Book which you would advise a forester on a large estate to keep.

7. The following is a statement of the cash transactions of William Thomson, forester on the Widemoor Estate, for the month of May 1902. Prepare therefrom a branched statement of Receipts and Expenditure, bringing out the balance of cash on hand at 31st May 1902. There was a balance of £35 due to the forester at 30th April:—

| 1902 | | | | | |
|---|---|---|---|---|---|
| May | 1. | Received price of 500 larch trees sold by public auction | £260 | 0 | 0 |
| " | " | Paid Wm. Thomson, salary for quarter | 50 | 0 | 0 |
| " | " | " County Assessments | 115 | 0 | 0 |
| " | 2. | " W Gunn, for young trees for nursery | 80 | 0 | 0 |
| " | " | " Great Northern Railway Co., carriage of do. | 5 | 0 | 0 |
| " | " | Received from John Ross, price of 120 dozen paling rails sold to him by private contract | 15 | 0 | 0 |
| " | 3. | Paid W. Jackson, assistant forester, salary for quarter | 20 | 0 | 0 |
| " | 4. | Received from John Wallace, price of 700 small oaks sold him by private contract | 35 | 0 | 0 |
| " | " | Paid R. Haig, for young trees for nursery | 50 | 0 | 0 |
| " | " | " W. Black, carter, carriage of do | 4 | 0 | 0 |
| " | 5. | Received price of 2000 Scots pine trees sold by public auction | 650 | 0 | 0 |
| " | 10. | Received from T. Wilson, price of 40 Scots pine trees sold to him by private contract | 14 | 0 | 0 |
| " | 12 | Paid G. Goodman, for advertising sale of timber | 3 | 0 | 0 |
| " | 13 | " T. Young, for saws supplied by him | 18 | 0 | 0 |
| " | 14. | " Auctioneer, commission on sales in April | 50 | 0 | 0 |
| " | 18 | Received price of 2500 larch trees sold by public auction | 1200 | 0 | 0 |
| " | 19. | Paid A. Jarvie, implement maker | 50 | 0 | 0 |
| " | 20. | " Fire Insurance Premium for Lodge, due 15th inst. | 2 | 0 | 0 |
| " | 24. | Received from R Hood, price of 25 tons firewood sold to him by private contract | 10 | 0 | 0 |
| " | 27. | Paid J Inkman, for printing catalogues | 5 | 0 | 0 |
| " | 29. | " C Smith, blacksmith | 15 | 0 | 0 |
| " | 31. | " Wages for month, as per list | 1150 | 0 | 0 |

*(An hour and a half allowed.)*

# DAIRY DEPARTMENT

## EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING

This Examination, instituted in 1897, is conducted by the National Agricultural Examination Board, appointed jointly by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland.

### REGULATIONS.

1. The Societies may hold annually in England and in Scotland, under the management of the National Agricultural Examination Board appointed by them, one or more Examinations for the National Diploma in the Science and Practice of Dairying; the Diploma to be distinguished shortly by the letters "N.D.D."

2. The Examinations will be held on dates and at places from time to time appointed and duly announced.

3. A deposit of £1 will be required from each candidate, which deposit will be returned only to those candidates who succeed in obtaining the Diploma at the first attempt. The Board may, at their discretion, allow an unsuccessful candidate to sit for one subsequent Examination without payment of a further deposit.

4. Forms of Entry for the Examination in England may be obtained from the Secretary of the Royal Agricultural Society of England, 13 Hanover Square, London, W., and must be returned to him duly filled up, with the deposit of £1, on or before 31st August.

5. Forms of Entry for the Examination in Scotland may be obtained from the Secretary of the Highland and Agricultural Society of Scotland, 3 George IV. Bridge, Edinburgh, and must be returned to him duly filled up, with the deposit of £1, on or before 31st August.

6. A candidate may enter for the Examination either in England or Scotland, but not in both; and a candidate who has once taken part in an Examination in England cannot enter for an Examination in Scotland, or *vice versa*. No candidate may sit for the Examination more than twice.

7. A candidate will be required to satisfy the Examiners, by means of written papers, practical work, and *vivâ voce*, that he or she has—

   (1) A general knowledge of the management of a Dairy Farm, including the rearing and feeding of Dairy Stock, the candidate being required to satisfy the examiners that he or she has had a thorough training and practical experience in all the details of Dairy work as pursued on a farm.

   (2) A thorough acquaintance, both practical and scientific, with everything connected with the management of a Dairy, and the manufacture of Butter and Cheese.

   (3) Practical skill in Dairying, to be tested by the making of Butter and Cheese.

   (4) Capacity for imparting instruction to others.

**8. The Board reserve the right to postpone, to abandon, or in any way, or at any time, to modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.**

By Order,

ERNEST CLARKE,
*Secretary, Royal Agricultural Society of England,*
13 Hanover Square, London, W.

JAMES MACDONALD,
*Secretary, Highland and Agricultural Society of Scotland,*
3 George IV. Bridge, Edinburgh.

*December* 1904

---

## SYLLABUS OF SUBJECTS OF EXAMINATION

### I.—GENERAL MANAGEMENT OF A DAIRY FARM.

1. *General Management of Pastures and Crops on a Dairy Farm.*

2. *Buildings.*—Situation, Surroundings. Construction, Ventilation, and Drainage of Farm Buildings. Suitability of building materials. Water supply. Construction and arrangements of Dairies: (*a*) for General Purposes; (*b*) for Special Purposes.

3. *Foods and Feeding.*—Summer and Winter Feeding of Dairy Cattle. Root crops. Green fodder. Ensilage. Different kinds of food and their composition. Their effect upon Milk, Butter, and Cheese. Special Foods used in Dairy Feeding. Preparation of food for Dairy Stock. Rearing and feeding of young Stock. Feeding and management of Pigs and Poultry.

4. *Dairy Cattle in Health and Disease.*—Characteristics of different Breeds, and choice of Dairy Cattle. General functions of the organs of the animal body. Breeding. Parturition. Organs which secrete milk. Process of milk secretion. Changes which food undergoes during digestion. Diseases of Dairy Cattle and their remedies.

### II.—MANAGEMENT OF A DAIRY.

1. *Milk and Cream.*—Process of Milking. Dairy Utensils and Appliances, hand and power. Cooling of Milk. Separation and ripening of Cream. Different systems of Cream-raising. Utilisation of Skim-milk. Keeping of Milk. Importance of Cleanliness. Diseases spread by Milk. Conveyance and sale of Milk. Milk records. Keeping of Dairy and Farm Accounts. Creameries. Butter and Cheese Factories. Different systems of Dairying and their comparative returns.

2. *Butter.*—Churns and other Butter-making appliances, hand and power. Souring of Cream. Churning. Washing and working of Butter. Butter-milk. Packing and transmission of Butter. Salting and keeping of Butter. Colouring. Characteristics of good Butter.

3. *Cheese.*—Principles of its manufacture. Making of different kinds of Cheese (from cream, whole-milk, and skim-milk). Acidity of Milk. Use of Rennet and its substitutes. Whey. Appliances for Cheese-making. Ripening and storage of Cheese. Packing and sale of Cheese. Making of Cream and other soft Cheeses.

## III.—CHEMISTRY AND BACTERIOLOGY

[*N.B.*—In this Section there will be expected of the candidate a sound understanding of the scientific principles underlying the practice of Dairying, a knowledge of the composition, nature, properties, and changes undergone by the different substances met with in Dairying, and a general acquaintance with the principles of laboratory methods so far as Dairying is concerned.]

1. *General Principles of Chemistry.*—The nature of elements and compound bodies. The different forms of matter—solid, liquid, gaseous. Specific gravity, and instruments for determining it. Temperature, and methods of measuring it. Thermometric scales. The influence of temperature in Dairy operations. Physical and chemical changes involved in the following: solution, precipitation, filtration, distillation, oxidation, and reduction. Acids, Bases, Salts—their distinctive properties. Acidity and Alkalinity—their influence and quantitative estimation.

The Atmosphere—its constituents and impurities; its influence on Dairy operations. Atmospheric pressure.

Water—constituents of pure and natural waters. The impurities of water and whence derived. The importance of a pure water-supply in Dairying.

General knowledge of the elementary chemistry of the following substances and their compounds so far as met with in Dairying: Potash, Soda, Ammonia, Lime, Phosphoric Acid, Alcohol, Acetic Acid, Carbonic Acid, Butyric Acid, Lactic Acid, Albumen, Casein, Fats, Milk-sugar, Glycerine, Pepsin.

Saponification of Fats.

2. *Milk and its Products.*—The nature, composition, properties, and chemical constituents of milk. Microscopical appearances presented by milk. The circumstances that affect the quality and quantity of milk produced by the cow. The influence of feeding. The changes which occur in the keeping of milk, and how produced. The natural and artificial souring of milk. Rennet, its nature and use. Physical and chemical changes involved in the making and keeping of Butter, and in the manufacture and ripening of Cheese. Separated Milk, Condensed Milk, Fermented Milk. The use of Preservatives. Methods of Milk-testing—Mechanical methods, their theory and practice. A general knowledge of the methods employed in the chemical analysis of Milk and Butter. Adulteration of Milk, Cream, Butter, and Cheese—the ways in which adulteration is practised, the changes in composition thereby produced, and a general knowledge of the methods employed in detecting the same.

3. *The Chemistry of Feeding.*—The principal constituents of Food materials, and the functions they severally fulfil. The influence of Food constituents on milk production. Assimilation and Digestion. Animal Heat and Respiration. Milk as a Food. The relation of Food to Manure.

4. *Bacteriology.*—Moulds. Yeasts. Bacteria. The principal kinds of Bacteria met with in Dairying—their forms, methods of reproduction, and conditions of life. The influence of physical agencies upon Bacterial life. Air and Water as carriers of Bacteria. The changes produced by Bacteria in milk and its products. Useful forms and their functions. Harmful forms and their effects—Coagulation, Discoloration, Taints, &c. Pathogenic organisms. The classification of organisms—organised ferments and enzymes. Methods of preparation of pure cultures and their practical use. Nutritive media. Pasteurisation and Sterilisation—the practical application of these to Dairy matters. Fermentation and Putrefaction. Disinfectants and Preservatives.

## IV.—PRACTICAL SKILL IN DAIRY WORK.

Candidates must be prepared—(1) to produce at or before the Examination a satisfactory certificate of proficiency in the Milking of Cows, signed by a practical Dairy Farmer, and to satisfy the Examiners by a practical test, if so required ; (2) to churn and make into Butter a measured quantity of Cream ; and (3) to make one Cheese of each of the following varieties : (i) Hard-pressed, of not less than 30 lb.; (ii) Veined or blue-moulded, of not less than 10 lb.; and (iii) also to make one or other of the following Soft Cheeses : Camembert, Coulommier, or Pont l'Evêque.

## V.—CAPACITY FOR IMPARTING INSTRUCTION TO OTHERS.

*Candidates must also show practically that they are familiar with the management of a Dairy, and are capable of imparting instruction to others.*

---

## EXAMINATIONS IN 1905.

**ENGLAND**—Monday, September 18, and following days, at the University College and British Dairy Institute, Reading; last date for receiving applications, Thursday, August 31.

**SCOTLAND**—Monday, September 25, and following days, at the Dairy School for Scotland, Kilmarnock ; last date for receiving applications, Thursday, August 31.

The following obtained the Diploma in Scotland in 1904 :—

Francis Billington, Elton Hall, Sandbach, Cheshire.
William Bywater, South View, Gomersal, Yorkshire.
James Kendall Earle, Ellerton, Scorton, Darlington.
John Earle, Ellerton, Scorton, Darlington
Robert Charles Gaut, 61 Belle Vue Road, Leeds.
Miss Bessie R. Kirkwood, Broadstone Hall, Beith.
Miss Janet Macnaughton, Montillie, Comrie.
Wilfred E. Smith, 7 Shandon Street, Edinburgh.
Miss Jeanie W A Speir, Newton Farm, Glasgow.
Hugh Stirling, 326 Gairbraid Street, Maryhill, Glasgow
Robert M. Wilson, Laws, Duns.

The following obtained the Diploma in England in 1904 .—

Miss Kate Amelia Baynes, University College and British Dairy Institute, Reading, and Eastern Counties Dairy Institute, Ipswich.
Harold Burkitt, British Dairy Institute, Reading.
Miss Emily Burkitt, British Dairy Institute, Reading.
Chrysostom J. Chrysakis, University College and British Dairy Institute, Reading.
Miss Gwladys Nest Davies, University College and British Dairy Institute, Reading, and Lleweni Hall Dairy School, Denbigh.
Miss Edith May Dawson, Midland Dairy Institute, Kingston, Derby.
Daniel Linford Freeman, Lancashire C.C. Dairy School, Hutton.
Abel Edwin Jones, University College of Wales, Aberystwyth, and British Dairy Institute, Reading.
Rafael Moncayo, University College and British Dairy Institute, Reading.

Miss ANNIE MYERSCOUGH, Lancashire C.C. Dairy School, Hutton.
Miss FELICIA ULRICA PARKINSON, Harris Institute, Preston, and University College and British Dairy Institute, Reading.
JOHN PORTER, Harris Institute, Preston, and Lancashire C.C. Dairy School, Hutton.
Miss ANNA FARQUHAR M'CONNELL, University College and British Dairy Institute, Reading.
Miss KATE MILLICENT NICKSON, Lancashire C.C. Farm, Hutton.
THOMAS WIBBERLEY, Lancashire C C. Dairy School, Hutton.
Miss ELLA WYSE, Cheshire C.C. Dairy Institute, Worleston.

---

PAST EXAMINATION PAPERS.

Copies of the Papers set at the Examinations in 1903 and 1904 may be had on application. Price 6d. per set.

---

# CHEMICAL DEPARTMENT

*Chemist to the Society*—JAMES HENDRICK, B.Sc., F.I C., F.C.S., Agricultural Department, Marischal College, Aberdeen.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding-stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

## MEMBERS' PRIVILEGES IN RESPECT OF ANALYSES.

The fees of the Chemist for analyses made for members of the Society shall, until further notice, be as follows:—

| | |
|---|---|
| The estimation of *one* ingredient in a manure or feeding-stuff, . | 5s |
| The estimation of *two* or *more* ingredients in do. . | 10s. |

*These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.*

Valuations of manures, according to the Society's scale of units, will be supplied if requested.

### MISCELLANEOUS.

| | £ | s. | d. |
|---|---|---|---|
| Analysis of water [1] to determine purity, hardness, and fitness for domestic use (not more than one analysis per year for any one member), . . . . . . | £1 | 0 | 0 |
| Analysis of agricultural products—hay, grain, ensilage, roots, &c., | 1 | 0 | 0 |
| Milk, full analysis, . . . . . . . | 0 | 10 | 0 |

[1] Cases containing bottles for water samples and instructions for sampling are sent from the laboratory on application.

| | |
|---|---|
| Milk, solids and fat, . . . | £0 5 0 |
| " fat only, . . . . | 0 2 6 |
| Butter, full analysis, . . . | 0 10 0 |
| " partial analysis (solids and fat), | 0 5 0 |
| Cheese, . . . . . . | 0 10 0 |
| Limestone, giving the percentage of lime, | 0 5 0 |
| Limestone, complete analysis, . | 1 0 0 |
| Lime, including ground lime, percentage of calcium oxide, . | 0 5 0 |
| " " " complete analysis, . . | 1 0 0 |
| Analysis of soil, to determine fertility and recommendation of manurial treatment, . . . . . . | 1 10 0 |
| Complete analysis of soil, . . . . . . | 2 10 0 |
| Search for poisons in food or viscera, . . . | 2 0 0 |
| Sulphate of copper, percentage of copper and purity, . | 0 5 0 |
| " " complete analysis, . . . . | 0 10 0 |
| Arsenic, carbolic acid and tar acids, and other poisons used in making sheep dips, &c., . . . . . | 5s. to £1 |

Samples should be sent (carriage paid) to James Hendrick, B.Sc., Agricultural Department, Marischal College, Aberdeen.

## INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

### MANURES.

Any method of sampling mutually agreed upon between buyer and seller may be adopted, but the following method is recommended as a very complete and satisfactory one: Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which it may contain being broken down with the hand. Of this mixture two samples of about half a pound each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the chemist for analysis.

### FEEDING-STUFFS.

Samples of feeding-stuffs which are in the form of meal may be taken in a similar manner.

Samples of cake should be taken by selecting four or more cakes from the bulk. These should be nutted to a size not larger than walnuts. The nutted cake should then be thoroughly mixed and samples of not less than one pound each taken from it. The samples should be put into bottles or tins, sealed up, and labelled. One sample should be sent to the analyst, and one or more duplicates retained by the purchaser.

### SOILS.

Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench vertical scrapings of the soil down to the top of the subsoil. Catch these on a clean board, and collect in this manner two pounds of soil taken from the whole surface of the section. Similar

scrapings of subsoil immediately below should be taken and preserved separately. Five or six similarly drawn samples at least should be taken from different parts of the field, and kept separate while being sent to the chemist, that he may examine them individually before mixing in the laboratory.

### VEGETABLE PRODUCTS.

*Turnips, &c.*, at least 50 bulbs carefully selected as of fair average growth.

*Hay, straw, ensilage, &c.*, should be sampled from a thin section cut across the whole stack or silo, and carefully mixed ; above 2 lb. weight is required for analysis.

*Grain* should be sampled like manures.

### DAIRY PRODUCE.

*Milk.*—Samples of milk from individual cows should be taken direct from the milk-pail after complete milking. Average samples from a number of cows should be taken immediately after milking. Specify whether the sample is morning or evening milk, or a mixture of these. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed. Samples of milk should be sent immediately to the analyst.

For most purposes a pint bottle of milk is a large enough sample.

*Butter and Cheese.*—About quarter-pound samples are required.

### WATERS.

When the water is from a well, it should be pumped for some minutes before taking the sample.

If the well has been standing unused for a long time, it should be pumped for some hours, so that the water may be renewed as far as possible.

If the well has been newly dug or cleaned out, it should be pumped as dry as possible, daily, for a week before taking the sample.

Water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck upwards, some inches below the surface. *Water from the surface should not be allowed to enter the bottle.*

Spring or stream water should not be sampled in very wet weather, but when the water is in ordinary condition. Such waters should be sampled by immersing the bottle, if possible; but if not deep enough for that purpose, a perfectly clean cup should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing it.

Interference with or disturbance of wells or springs, or the ground in their immediate vicinity, must be carefully avoided during sampling, and for at least twenty-four hours before it.

After a sample has been taken, it should be sent to the laboratory as speedily as possible.

A description of the source and circumstances of the water should accompany the sample, as the interpretation of the analytical results depends to some extent on a knowledge of such particulars.

*N.B.*—Stone jars and old wine bottles are unsuitable for conveying samples. Winchester quarts chemically cleaned should be obtained from the laboratory, Marischal College, Aberdeen.

## LOCAL ANALYTICAL ASSOCIATIONS.

With the view of encouraging, as well as regulating the conduct of, Local Analytical Associations, the Society, from 1881 to 1893, contributed from its funds towards their expenses a sum not exceeding £250 annually. In view of the passing of the Fertilisers and Feeding Stuffs Act, 1893, it was decided, at a meeting of the Directors on the 6th of December 1893, to discontinue that grant after the 1st of March 1894.

## COMPOSITION AND CHARACTERISTICS OF MANURES AND FEEDING-STUFFS.

(*See* '*Transactions,*' *Fifth Series, vol. xi.* 1899.)

## FORMS OF GUARANTEE

### Guarantee of Manure.

I guarantee that the manure called.. ..................and sold by me to ............................................contains a minimum of—

| | | |
|---|---|---|
| *Soluble phosphoric acid* | =Phosphate of lime dissolved | .. ....per cent. |
| *Insoluble phosphoric acid* | =Phosphate of lime undissolved | ..... . per cent. |
| *Potash salts* . . | =Potash ($K_2O$) . . . . | ... . .per cent. |
| *Total nitrogen* . . | =Ammonia . . . . . | ....... per cent. |

Signature of seller........................

*Date*..................19

### Guarantee of Feeding-Stuff.

I guarantee that the feeding-stuff called................and sold by me to ..........................................contains a minimum of—

. per cent albuminoids.
. per cent oil.
. per cent carbohydrates.

Signature of seller.

*Date*..................19 .

# UNITS TO BE USED IN DETERMINING THE COMMERCIAL VALUE OF MANURES.[1]

*Terms*—CASH, including Bags gross weight—not including Carriage.

*N.B.*—These units are based on the RETAIL PRICES at the following seaports: Berwick, Leith, Bo'ness, Dundee, and Glasgow. When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price at which TWO TONS may be bought in fine sowable condition Larger purchases may be made on more favourable terms, but for smaller purchases an extra charge of 1s. 6d per ton is made

## For Season 1905.

## CASH PRICES as Fixed on 1st February.

| Items to be Valued. | Peruvian (Riddled). Ammoniacal | Peruvian (Riddled). Phosphatic | Bone-Meal. | Steamed Bone Flour. | Dissolved or Vitriolated Bones. | Superphosphates. |
|---|---|---|---|---|---|---|
| | P unit | P unit | P unit | P unit | P unit | P unit |
| Phosphates dissolved | 1/4 | 1/3 | .. | | 2/7 | 1/9½ |
| " undissolved | | | 1/4 | 1/8 | 1/4 | |
| Potash | 3/6 | 3/6 | .. | | .. | |
| Nitrogen | 15/9 | 15/- | 12/1 | 12/1 | 15/9 | |
| or Ammonia | 13/- | 12/6 | 10/- | 10/- | 13/- | . |
| Prices per ton— | | | | | | |
| From | 150/ upwards | 105/ upwards | 105/- | 90/- | 108/- | 45/- |
| To | . | . | 115/- | 100/ | 112/- | 65/- |

| Manures. | Guarantee. | Price per Ton. | Unit. |
|---|---|---|---|
| | Per cent. | £ s d. | |
| Sulphate of ammonia[2] . ex works | 24 Ammonia | 13 0 0 | Am. = 10/10 |
| Nitrate of soda, 95 per cent[2] ex ship | 19 " | 10 15 0 | " = 11/4 |
| Muriate of potash, 80 per cent " | 50 Potash | 8 15 0 | Pot. = 3/6 |
| Sulphate of potash, 80 per cent, or over " | .. | .. | " = 3/9 |
| Kainit . . . . . " | 12 5 Potash | 2 0 0 | " = 3/2 |
| Potash salts . . . . . | 30 " | 4 12 6 | " = 3/1 |
| Thomas-slag phosphate at place of production | 30 Phosphate | 1 15 0 | Phos. = 1/2 |
| " " . . . . | 38 " | 2 0 0 | " = 1/1 |

Note.—*This Schedule of Unit Prices of Manures and Feeding-Stuffs is revised each year in the first week of February. Copies of the Schedule may be had by Members any time thereafter.*

[1] Instructions regarding units and the valuation of manures are given on p. 36.

[2] These are the February prices, but they are subject to variation from month to month or oftener.

**Feeding-Stuffs.**

| | Average Analyses | | | Price per Ton. |
|---|---|---|---|---|
| | Album. | Oil. | Carbo-hydrates. | £ s. d. |
| Linseed-cake . . | 28 | 9 | 35 | 7 10 0 |
| " Canadian or American | 30 | 7 | 35 | 6 17 6 |
| Decorticated cotton-cake . | 45 | 10 | 20 | 6 15 0 |
| " " Seed-meal | | | .. | 6 10 0 |
| Undecorticated " (Egyptian) | 24 | 7 | 25 | 5 0 0 |
| " " (Bombay) | | . | | 4 7 6 |
| Bean-meal[1] . | 25 | 2 | 50 | 6 12 0 |
| Rice-meal . . . | 11 | 10 | 50 | 4 10 0 |
| Locust-bean meal | 6 | 2 | 70 | 5 10 0 |
| Dried Distillery grains | 20 | 8 | 50 | 5 5 0 |
| " Brewery " | 20 | 8 | 50 | 4 12 6 |
| Barley-bran | 15 | 5 | 50 | 5 0 0 |
| Indian corn (American)[1] | 10 | 5 | 55 | 4 17 6 |
| Maize-germ meal . | . | | . | 5 10 0 |
| Paisley meal | 15 | 9 | 60 | 4 17 6 |
| Linseed (whole) . | 20 | 35 | 14 | 10 10 0 |
| Linseed-oil | . | . | | 14 0 0 |
| Treacle . . . | .. | .. | | 4 15 0 |

[1] These are the February prices, but they are subject to variation from month to month or oftener.

## CLASSIFICATION OF MANURES.

| | |
|---|---|
| Bone-meal . . | Genuine bone-meal contains from 48 per cent to 55 per cent phosphates, and from 4 per cent to 5 per cent ammonia. If phosphates are low, ammonia will be high, and conversely. |
| Steamed bone-flour | Ground to flour and containing about 60 to 65 per cent phosphates, and about 1 to 2½ per cent ammonia |
| Dissolved bones . | Must be pure—*i e*, containing nothing but natural bones and sulphuric acid. |
| Mixtures and compound manures | To be valued according to the unit values (as given above) of the ingredients of which they are guaranteed *and also found* to be composed, with an addition of 7s 6d per ton for mixing.<br>High-class compound manures to be valued at the mean between the highest and lowest units applicable to each ingredient. |
| Thomas-slag | Not less than 80 per cent of the phosphate should be citric soluble (Wagner's method)<br>Fineness of grinding is of paramount importance The coarsest kind used should be so finely ground that at least 80 per cent passes through a sieve of about 9600 holes per sq. inch. |

## INSTRUCTIONS FOR VALUING MANURES.

The unit used for the valuation of manures is the hundredth part of a ton, and as the analyses of manures are expressed in parts per hundred, the percentage of any ingredient of a manure when multiplied by the price of the unit of that ingredient represents the value of the quantity of it contained in a ton.

As an example take muriate of potash—a good sample (see p. 35) will be guaranteed to contain 80 per cent *pure* muriate of potash ; the other 20 per cent consisting of unimportant impurities such as common salt. But all potash manures are valued according to the amount of Potash

they yield, and 80 per cent of pure muriate of potash yields 50 per cent potash ($K_2O$)—*i.e.*, 50 units per ton, and as a ton of muriate of potash costs £8, 15s. the price of the unit is the fiftieth part of that—viz., 3s. 6d. If on analysis a sample of muriate of potash guaranteed to contain 50 per cent of potash is found to contain only 49 per cent, the price per ton will be 3s. 6d. less—viz., £8, 11s. 6d.

Similarly with all other manures the price per unit is derived from the price per ton of a sample of good material up to its guarantee, and therefore the proper price per ton of a manure is found by multiplying the price of the unit of the valuable ingredient by the percentage as found by analysis. If a manure contains more than one valuable ingredient the unit value of each ingredient is multiplied by its percentage, and the values so found when added together give approximately the price per ton of the manure.

Nitrate of soda contains no ammonia but it contains nitrogen, and 14 units of nitrogen are equivalent to 17 units of ammonia, and it is the custom in Scotland to value all nitrogenous manures not according to the nitrogen they contain but according to its equivalent of ammonia.

The commercial values of manures are determined by means of the UNITS in the following manner:—

Take the analysis of the manure, and look for the following substances:—

| | |
|---|---|
| Phosphates dissolved (or soluble phosphate) | No other items but these are to be valued. |
| „ undissolved (or insoluble „ ) | |
| Nitrogen = Ammonia . . . . . | |
| Potash . . . . . . . . . | |

*Should the analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.*

Suppose the manure is bone-meal:—

An ordinary bone-meal will contain about 50 per cent phosphate and about 4½ per cent ammonia. The units for bone-meal are 1s. 4d. for phosphate and 10s. for ammonia. Therefore the value is—

| | | | |
|---|---|---|---|
| Insol. phosphate, 50 times 1s. 4d., equal to | £3 | 6 | 8 |
| Nitrogen = Ammonia, 4½ times 10s., equal to | 2 | 5 | 0 |
| Say | £5 | 11 | 8 per ton. |

Suppose the manure is dissolved or vitriolated bones:—

It must be guaranteed "pure."

The units in the Schedule are 2s. 7d. for soluble phosphate, 1s 4d. for insoluble phosphate, and 13s. for ammonia.

The analysis will be about 16 per cent soluble phosphate, 20 per cent insoluble phosphate, and 3½ per cent ammonia. In that case the value would be—

| | | | | | | |
|---|---|---|---|---|---|---|
| Sol. phosphate, | 16 times 2s. 7d., | equal to | £2 | 1 | 4 |
| Insol. „ | 20 „ 1s. 4d., | „ | 1 | 6 | 8 |
| Nitrogen = Ammonia, | 3½ „ 13s., | „ | 2 | 5 | 6 |
| | | Say | £5 | 13 | 6 per ton. |

Suppose the manure is a superphosphate,—say an ordinary superphosphate, with 28 per cent soluble phosphate and 3 per cent insoluble phosphate. It is valued thus:—

Sol. phosphate, 28 times 1s. 9½d., equal to, say, £2, 10s. 2d. per ton.
*Insoluble phosphate is not valued in a superphosphate.*

*Note.*—The units have reference solely to the COMMERCIAL VALUES of Manures, and not to their AGRICULTURAL VALUES.

*Thus, in stating soluble phosphate in dissolved bones at 2s. 7d. per unit, and that in superphosphate at 1s. 9½d., it is meant that these are the prices per unit at which soluble phosphate can be bought in these two manures; but it does not mean that the soluble phosphate in the one is 9½d. per unit better as a manure than that in the other. It is probably no better.*

# BOTANICAL DEPARTMENT

*Consulting Botanist to the Society*—A. N. M'ALPINE,
6 Blythswood Square, Glasgow.

The Society have fixed the following rates of charge for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

*Scale of Charges.*

1. A report on the purity, amount, and nature of foreign materials, and the germinating power of a sample of seed, 1s.
2. Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention, 1s.
3. Report on any disease affecting farm crops, 1s.
4. Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value, 1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural or horticultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

*Purchase of Seeds.*

The purchaser should obtain from the vendor, by invoice or other writing, the proper designation of the seed he buys, with a guarantee of the percentage of purity and germination, and of its freedom from ergot, and in the case of clover, from the seeds of dodder or broom-rape.

It is strongly recommended that the purchase of *prepared mixtures* of seeds should be avoided. The different seeds should be purchased separately and mixed by the farmer: mixtures cannot be tested for germination.

*The Sampling of Seeds.*

The utmost care should be taken to secure a fair and honest sample. This should be drawn from the bulk delivered to the purchaser, and not from the sample sent by the vendor.

When legal evidence is required, the sample should be taken from the bulk, and placed in a sealed bag in the presence of a witness. Care should be taken that the sample and bulk be not tampered with after delivery, or mixed or brought in contact with any other sample or bulk.

At least one ounce of grass and other small seeds should be sent, and two ounces of cereals and the larger seeds. When the bulk is obviously impure the sample should be at least double the amount specified.

Grass seeds should be sent at least four weeks, and seeds of clover and cereals two weeks, before they are to be used.

The exact name under which the sample has been sold and purchased should accompany it.

*Reporting the Results.*

The Report will be made on a schedule in which the nature and amount of impurities will be stated, and the number of days each sample has been under test, with the percentage of the seeds which have germinated.

"Hard" clover seeds, though not germinating within the time stated, will be considered good seeds, and their percentage separately stated.

The impurities in the sample, including the chaff of the species tested, will be specified in the schedule, and only the percentage of the pure seed of that species will be reported upon; but the REAL VALUE of the sample will be stated. The Real Value is the combined percentages of purity and germination, and is obtained by multiplying these percentages and dividing by 100. thus in a sample of Meadow Fescue having 88 per cent purity and 95 per cent germination, 88 multiplied by 95 gives 8360, and this divided by 100 gives 83·6, the Real Value.

*Selecting Specimens of Plants.*

The whole plant should be taken up and the earth shaken from the roots. If possible the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage paid) must be addressed to Professor M'Alpine, Botanical Laboratory, 6 Blythswood Square, Glasgow.

## INSECT PESTS.

Arrangements have been made with Mr R. Stewart MacDougall, M.A., D.Sc., Edinburgh, to advise members of the Society regarding insects or allied animals which, in any stage of their development, infest—

(a) Farm crops.
(b) Stored grain.
(c) Garden and greenhouse plants.
(d) Fruit and fruit trees.
(e) Forest trees and stored timber.
(f) Live stock (including poultry).

Members consulting Dr MacDougall will please forward with their queries examples of the injured plants, or the injured parts of plants, &c., as well as specimens of the insects or other animals believed to be the cause of the injury.

Specimens should be sent in tin or wooden boxes, or in quills, to prevent injury in transmission.

Address letters and parcels (carriage or postage paid) to Dr R. Stewart MacDougall, 13 Archibald Place, Edinburgh.

The Directors have fixed the fee payable by members to Dr MacDougall at 1s. for each case upon which he is consulted: this fee must be sent to him along with the application for information.

# PREMIUMS

## GENERAL REGULATIONS FOR COMPETITORS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to the Premium offered, or a portion of it, will be opened without the author's consent.

4. Reports for which a Premium, or a portion of a Premium, has been awarded, become the property of the Society, and cannot be published in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. The Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded or accepted. Weights and measurements must be indicated by the imperial standards.

7. The Directors, before or after awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all matters relating to Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject, whether included in the Premium List or not; and if the topic and the treatment of it are both approved, the writer may be remunerated and his paper published.

## CLASS I.

# REPORTS.

## SECTION 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

### FOR APPROVED REPORTS.

1. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purpose chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

2. Approved Reports on other suitable subjects To be lodged by 1st November in any year.

## SECTION 2.—ESTATE IMPROVEMENTS.

### FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty acres of Waste Land—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

3. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land

—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Reports in competition for Nos. 2, 3, and 4 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

5. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

6. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 5 and 6 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

## SECTION 3.—HIGHLAND INDUSTRIES AND FISHERIES.

### FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland—Five Sovereigns. To be lodged by 1st November in any year.

## SECTION 4.—MACHINERY.

### FOR APPROVED REPORTS.

To be lodged by 1st November in any year.

## SECTION 5.—FORESTRY DEPARTMENT.

### FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat-bog—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

# CLASS II.

## DISTRICT COMPETITIONS.

### REGULATIONS 1905.

*As to payment of Grants, see Regulation* 10, *Section* 1.

*Grants in aid of* DISTRICT COMPETITIONS *for* 1906 *must be applied for before* 1*st November* 1905, *on Forms to be obtained from the Secretary.*

*When a Grant has expired, the District cannot apply again for aid for two years.*

## SECTION I.—GRANTS TO DISTRICT SOCIETIES FOR HORSES, CATTLE, SHEEP, AND PIGS.

1. CLASS OF STOCK—LIMIT OF GRANTS, £340.—The Highland and Agricultural Society will make Grants to District Societies to deal with, as in the opinion of the District Societies the need of each district may require, for such classes of Stock of Horses, Cattle, Sheep, and Pigs as are embraced in the General Show Prize List of the Highland and Agricultural Society. The total sum to be expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £340 in any one year.

2. GRANT TO DISTRICT, £12.—The portion of the Grant to any one District Society shall not exceed the sum of £12 in any one year.

3. ALLOCATION OF GRANT.—The Grant from the Highland and Agricultural Society is not to be applied as a Grant in aid of the Premiums

offered by the Local Society, but must be offered in the form of separate Prizes for the Animals chosen; *and the Prizes must be announced in the Premium List and Catalogue of the Show as "given by the Highland and Agricultural Society."*

4. Continuance of Grant Three Years—Advertising.—The Grant shall continue for three alternate years, provided always that the District Society shall, in the two intermediate years, continue the competition by offering Premiums for the same class of Stock as that selected in each previous year to compete for the Highland and Agricultural Society's Prizes. If no competition takes place for two years the Grant expires.

5. When it is agreed to hold the General Show of the Society in any district, no provincial show shall be held in that district in the months of June, July, or August.

6. Medals.—In the two alternate years the Highland and Agricultural Society will place three Silver Medals at the disposal of the District Societies, for the same classes of Stock as those for which the Money Premiums are offered, provided that not less than three lots are exhibited in the same class.

7. Rules of Competition.—The Rules of Competition for the Premiums, the Funds for which are derived from Grants of the Highland and Agricultural Society, shall be such as are generally enforced by the Society receiving the Grant for Premiums offered by itself.

8. Area and Parishes—Five Parishes.—When making application for Grants from the Highland and Agricultural Society, the District Society must delineate the area and the number of parishes comprised in the district, and, *except in special cases*, no District Society shall be entitled to a Grant whose show is not open to at least *five* Parishes.

9 Nomination of Members.—The Directors may nominate one or more members of the Highland and Agricultural Society resident in the district, whose duty it shall be to see that the conditions imposed by the Board are complied with.

10. Reports.—Blank Reports will be furnished to the Secretaries of the different District Societies. These Reports must in all details be completed and lodged with the Secretary of the Highland and Agricultural Society on or before the 1st of November next following the competition, both in the years when the Grant is given and in the two intermediate years, for the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All such Reports must be signed and certified by the Members of the Highland and Agricultural Society nominated under Rule 8.

11. Grants—When Paid.—The Grants made to District Societies will be paid in the first week of December after the Reports of the awards of the prizes have been received and found to be in order and passed by the Board of Directors, the Money Grants being paid to the Secretaries of the Local Societies and the Medals sent direct to the winners. The Secretary of the District Society must not on any condition whatever pay any premium offered by the Highland and Agricultural Society until he has been informed that the awards are in order and has received the grant from the Highland and Agricultural Society.

12. Renewal of Application.—No application for renewal of a Grant to a District Society will be entertained until the expiration of *two years* from the termination of the last Grant.

13. Disposal of Applications.—In disposing of applications for District Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those District Societies which have been longest off the list.

14. Dairy Produce.—Upon application being made by District Societies, a limited number of Medals will be placed at the disposal of District Societies for Dairy Produce.

## DISTRICTS.

1. Atholl and Weem.—*Convener*, John Scott, Eastertyre, Ballinluig; *Secretary*, Hugh Mitchell, Pitlochry. Granted 1900. (In abeyance in 1904 on account of the Perth Show.)
2. Moffat and Upper Annandale.—*Convener*, John Young, Meikleholmside, Moffat; *Secretary*, John Young, High Street, Moffat. Granted 1900. (In abeyance in 1903 on account of the Dumfries Show.)
3. Glenkens.—*Convener*, Colonel J. M. Kennedy of Knocknalling, Dalry, Galloway; *Secretary*, James M'Gill, New Galloway. Granted 1900. (In abeyance in 1903 on account of the Dumfries Show.)
4. Doune.—*Convener*, John Scrimgeour, Doune Lodge, Doune; *Secretary*, William Gray, Inspector of Poor, Doune. Granted 1901.
5. Formartine.—*Convener*, George Walker, Tillygreig, Udny, Aberdeen; *Secretary*, James Skinner, Pitmedden, Udny, Aberdeen. Granted 1900. (In abeyance in 1902 on account of the Aberdeen Show.)
6. Deeside Union.—*Convener*, Lieut.-Col. Innes of Learney, Torphins; *Joint-Secretaries*, John Davidson and John Cooper, Banchory. Granted 1903.
7. Turriff.—*Convener*, James Beaton, Aspen Bank, Turriff; *Secretary*, R. Cruickshank, Claymires, Turriff. Granted 1903.
8. Marnoch and Cornhill.—*Convener*, James O. Morrison of Culvie, Tipperty, Banff; *Secretary*, Douglas B. Leask, North of Scotland Bank, Aberchirder. Granted 1903
9. Kirkintilloch.—*Convener*, Alex. Park, 175 Hope Street, Glasgow; *Secretary*, Andrew Matson, National Bank, Kirkintilloch. Granted 1903.
10. Ardoch.—*Convener*, George Nairn, Boreland, Blackford; *Secretary*, William J. Reid, Burnside, Braco. Granted 1903.
11. West Teviotdale.—*Convener*, Charles J. Grieve, Branxholm Park, Hawick; *Secretary*, James Oliver, Thornwood, Hawick. Granted 1903.
12. Eastern District of Stirlingshire. — *Convener*, Robert Meikle, Bearcrofts, Grangemouth; *Secretary*, William Wright, Newmarket Street, Falkirk. Granted 1903.
13. Castle Douglas. — *Convener*, John M'Kie of Bargally, Ernespie, Castle Douglas; *Secretary*, Malcolm M'L. Harper, British Linen Co. Bank, Castle Douglas. Granted 1902. (In abeyance in 1903 on account of the Dumfries Show.)
14. United Banffshire.—*Convener*, William MacIntosh, Factor, Banff; *Secretary*, John A. Badenoch, Accountant, Banff. Granted 1905.
15. Caithness.—*Convener*, John Miller of Scrabster, Thurso; *Secretary*, James Shearer, Bank of Scotland, Wick. Granted 1905.
16. Mid-Annandale.—*Convener*, James Lindsay, Whitecastles, Lockerbie; *Secretary*, John A. Mackenzie, Solicitor, Lockerbie. Granted 1905.
17. Dalkeith.—*Convener*, James Cook, Arniston, Gorebridge; *Secretary*, T. Watson Dods, Auctioneer, Dalkeith. Granted 1905.
18. Morayshire.—*Convener*, Colonel C. J. Johnston of Lesmurdie, Elgin; *Secretary*, W. Rose Black, Town and County Bank, Elgin. Granted 1905.

19. ANGUS.—*Convener*, David Hume, Barrelwell, Brechin; *Secretary*, James Kydd, 86 High Street, Arbroath. Granted 1905.
20. SPEY, AVEN, AND FIDDOCHSIDE.—*Convener*, Sir George Macpherson Grant of Ballindalloch, Bart.; *Secretary*, Robert Dick Stuart, Seafield Square, Rothes. Granted 1905.
21. WESTERN DISTRICT OF FIFE.—*Convener*, Hugh Butters, Masterton, Dunfermline; *Secretary*, Robert Husband, 1 Douglas Street, Dunfermline. Granted 1905.
22. DALBEATTIE.—*Convener*, W. J. H. Maxwell of Munches, M.P., Dalbeattie; *Secretary*, J. E. Milligan, Solicitor, Dalbeattie. Granted 1905
23. WEST LOTHIAN.—*Convener*, ; *Secretary*, Archibald Cochrane, Trinlaymire, Linlithgowshire. Granted 1905.
24. UNITED EAST LOTHIAN.—*Convener*, William Gillespie, Athelstaneford Mains, Drem; *Secretary*, John Stirling, Solicitor, Haddington. Granted 1902.
25. LOCHABER.—*Convener*, R. E. Jones, Fassifern, Fort William; *Secretary*, N. B. Mackenzie, jun., Estate Office, Fort William. Granted 1902.
26. STRATHENDRICK.—*Convener and Secretary*, W. Watson Murray, Catter House, Drymen. Granted 1902.
27. STRATHBOGIE.—*Convener*, Charles Kemp of Auchencrieve, Rothiemay; *Secretary*, J. G. Stewart, Huntly. Granted 1901. (In abeyance in 1902 on account of the Aberdeen Show.)
28. DUMFRIES.—*Convener*, M. S. M'Kerrow, Boreland of Southwick, Dumfries; *Secretary*, John Blacklock, Solicitor, Dumfries. Granted 1901. (In abeyance in 1903 on account of the Dumfries Show.)
29. INVERNESS-SHIRE.—*Convener*, J. Huntly Macdonald, Charleston, Inverness; *Secretary*, D. Gray, 36 Union Street, Inverness. Granted 1903. (In abeyance in 1903. Grant given to the Joint Show.)
30. KINCARDINESHIRE.—*Convener*, George Milne, Easttown, Glenbervie, Drumlithie; *Secretary*, A. B. Annandale, Stonehaven. Granted 1904.
31. BLACK ISLE.—*Convener*, Major Matheson, Insch, Avoch; *Secretary*, James M. Fraser, Caledonian Bank, Fortrose. Granted 1904. (In abeyance in 1905 on account of the Glasgow Show.)
32. BUCHLYVIE AND GARTMORE.—*Convener*, Paul Hendry, Gartmore, Port of Menteith; *Secretary*, Daniel Fisher, Garchel, Buchlyvie. Granted 1904
33. PERTHSHIRE.—*Convener*, David Dow, Balmanno, Bridge of Earn; *Secretary*, John F. Smith, Eastfield, Bridge of Earn. Granted 1903. (In abeyance in 1904 on account of the Perth Show.)
34. FORTH.—*Convener*, David M'Culloch, The Inn, Forth; *Secretary*, William Lawson, Guildhouse, Forth. Granted 1904. (In abeyance in 1905 on account of the Glasgow Show.)
35. NEW MONKLAND.—*Convener*, John W. Findlay, 4 Bank Street, Airdrie; *Secretary*, John A. White, Royal Bank, Airdrie. Granted 1904. (In abeyance in 1905 on account of the Glasgow Show.)
36. ISLAY, JURA, AND COLONSAY.—*Convener*, John Laughton, Ellabus, Islay; *Secretary*, Robert Cullen, Solicitor, Bridgend, Islay. Granted 1901. (In abeyance in 1905 on account of the Glasgow Show.)
37. ARRAN.—*Convener*, James Allan, Balnacoole, Shiskine; *Secretary*, William Brown, Shedock, Shiskine. Granted 1901. (In abeyance in 1905 on account of the Glasgow Show.)
38. CARRICK.—*Convener*, Alex. Cross of Knockdon, 19 Hope Street, Glasgow; *Joint-Secretaries*, David Brown and Charles W. Brown,

. Royal Bank, Maybole. Granted 1903. (In abeyance in 1905 on account of the Glasgow Show.)

39. CUMNOCK.—*Convener*, James Clark, Crossflatt, Muirkirk ; *Secretary*, David Stevenson, Changue, Cumnock. Granted 1903. (In abeyance in 1905 on account of the Glasgow Show.)

40. UPPER WARD OF LANARKSHIRE.—*Convener*, John Morton, Whelphill, Abington, Lanark ; *Secretary*, W. D. Brown, Fernielea, Lanark. Granted 1903. (In abeyance in 1905 on account of the Glasgow Show.)

In 1905.

Nos. 1, 2, 3, 4, and 5 are in competition for the last year.

Nos. 6, 7, 8, 9, 10, 11, 12, and 13 are in competition for the second year.

Nos. 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23 are in competition for the first year.

Nos. 24, 25, 26, 27, 28, 29, 30, 31, 32, and 33 compete for local Premiums.

Nos. 34, 35, 36, 37, 38, 39, and 40 are in abeyance on account of the Glasgow Show.

## SECTION 2.—GRANTS TO HORSE ASSOCIATIONS, &c., FOR STALLIONS FOR AGRICULTURAL PURPOSES.

1. HORSES—LIMIT OF GRANT, £210.—The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £210 in any one year.

2. GRANT TO EACH, £15.—The portion of the Grant to any one Horse Association, &c., shall not exceed the sum of £15 in any one year.

3. CONTINUANCE OF GRANT THREE YEARS—INTERMEDIATE YEAR.—The Grant shall continue for three alternate years, provided always that the Horse Association or Society shall, in the two intermediate years, offer at least a sum equal in amount to that granted by the Highland and Agricultural Society for the hire of a Horse in connection with the Association or Society to whom the Grant is made.

4. NOMINATION OF MEMBERS.—The Directors of the Highland and Agricultural Society shall nominate one or more members of the Highland and Agricultural Society, resident in the Districts in which the Society benefited is located, whose duty it shall be to see that the conditions imposed by the Board are complied with.

5. REPORTS—PENALTY FOR NOT ENGAGING HORSE.—No Grant by the Highland and Agricultural Society to Horse Associations, &c., will be paid unless a report, signed and certified by the members appointed under Rule 4, be furnished to the Highland and Agricultural Society not later than the 1st of November in each year in which the Grant is made, and also in the alternate years, stating that a Horse has been engaged by the Horse Association or other Society to whom the Grant is made ; and in the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

6. RULES 10 (Time of Payment), 11 (Renewal of Grant), and 12 (Disposal of Applications) applicable to Section 1, shall be applicable to Section 2.

## DISTRICTS.

1. POLTALLOCH. — *Convener*, R. A. Meikle, Ri-cruin, Lochgilphead; *Secretary*, Arch. Taylor, Ri-cruin, Lochgilphead. Granted 1901.
2. SPEYSIDE CLYDESDALE HORSE-BREEDING SOCIETY.—*Convener*, Colonel George Smith Grant, Minmore, Glenlivet; *Secretary*, George Anderson, Banker, Craigellachie. Granted 1901.
3. ATHOLL AND BREADALBANE. — *Convener and Secretary*, James J. Gillespie, St Colmes, Ballinluig. Granted 1901.
4. GIGHA.—*Convener*, W. J. Yorke Scarlett of Gigha; *Secretary*, W. W. Philip, Estate Office, Gigha. Granted 1903.
5. CUMBERNAULD, KILSYTH, AND KIRKINTILLOCH.—*Convener*, Alexander Whitelaw of Gartshore, Kirkintilloch; *Secretary*, Alexander Park, 175 Hope Street, Glasgow. Granted 1903.
6. GATEHOUSE.—*Convener and Secretary*, D. Y. Veitch, Low Creoch, Gatehouse. Granted 1903.
7. SCONE, STRATHORD, AND MURTHLY. — *Convener*, W. S. Ferguson, Pictstonhill, Perth; *Secretary*, James Stewart, Friarton, Perth. Granted 1903.
8. KELSO DISTRICT CLYDESDALE HORSE SOCIETY. — *Convener*, W. G. Hogarth, Linton Bankhead, Kelso; *Secretary*, A. Riddell, 3 Square, Kelso. Granted 1903.
9. CAITHNESS HORSE-BREEDING ASSOCIATION.—*Convener*, Robert Morris, Reiss Lodge, Wick; *Secretary*, Alex. Dinnet, Upper Gillock, Wick. Granted 1905.
10. MORAY HORSE-BREEDING ASSOCIATION — *Convener*, Andrew B. Leitch, Inchstelly, Forres; *Secretary*, H. M S. Mackay, Bank Agent, Elgin. Granted 1905.
11. CARSE AND DUNDEE DISTRICT STALLION SOCIETY.—*Convener*, Captain Clayhills Henderson of Invergowrie, Dundee; *Secretary*, Alex Anderson, Berryhill, Dundee. Granted 1905.
12. SELKIRK AND GALASHIELS. - *Convener*, Thomas D. Connochie, M.R C V.S, Galashiels; *Secretary*, I O. Finlay, National Bank House, Galashiels. Granted 1905.
13. BUCHLYVIE AND VALE OF MENTEITH HORSE-BREEDING SOCIETY.—*Convener*, Stephen Mitchell of Boquhan, Kippen Station; *Secretary*, John Drysdale, Arngibbon, Port of Menteith Station. Granted 1905.
14. DEESIDE HORSE-BREEDING ASSOCIATION.—*Convener*, Sir Thomas Burnett of Leys, Bart, Crathes Castle; *Secretary*, John Cooper, Ley, Banchory. Granted 1902.
15. VALE OF ALFORD HORSE-BREEDING SOCIETY.—*Convener*, William A. Mitchell, Auchnagathle, Whitehouse, Aberdeen; *Secretary*, John Reid, Balquharn, Alford, N.B. Granted 1902.
16. CLACKMANNANSHIRE UNION.—*Convener*, Wm. M'Gregor, Arns, Alloa; *Secretary*, Alex. L. Roxburgh, 28 Mar Street, Alloa. Granted 1902.
17. LOCKERBIE ENTIRE HORSE SOCIETY.—*Convener*, Allan Murray, Castlemilk Mill, Lockerbie; *Secretary*, James R. Byers, Solicitor, Lockerbie. Granted 1902.
18. EAST OF FIFE ENTIRE HORSE SOCIETY.—*Convener*, J. Brewster, Denburn, Crail; *Secretary*, William Rutherford, Thirdpart, Crail. Granted 1902.
19. WINDYGATES.—*Convener*, R. M. Pilkington, Bridgend, Windygates; *Secretary*, William Shepherd, Royal Bank, Leven. Granted 1902.
20. INVERNESS-SHIRE. — *Convener*, J. Huntly Macdonald, Charleston, Inverness; *Secretary*, D. Gray, 36 Union Street, Inverness. Granted 1902.

21. Perth and Coupar-Angus Horse Improvement Society.—*Convener*, W. S. Ferguson, Pictstonhill, Perth; *Secretary*, James Stewart, Friarton, Perth. Granted 1902.
22. Insch and Garioch Horse-Breeding Society.—*Convener*, Peter Bruce, Myreton, Insch, Aberdeen; *Secretary*, George A. Bruce, Inschfield, Insch, Aberdeen. Granted 1904.
23. Upper Donside.—*Convener*, Alex. Fletcher, Glenbucket Mains, Glenbucket; *Secretary*, John Milne, Town and County Bank, Kildrummy. Granted 1904.
24. Lammermoor Pastoral.—*Convener*, George G. Turnbull of Abbey St Bathans, Grant's House; *Secretary*, Thos. Stephenson, Duns Granted 1904.
25. Upper Nithsdale Horse Society.—*Convener*, D. M. MacRae, Stenhouse, Thornhill; *Secretary*, David Paterson, Solicitor, Thornhill Granted 1904.

In 1905.

Nos. 1, 2, and 3 are in competition for the last year.
Nos. 4, 5, 6, 7, and 8 are in competition for the second year.
Nos. 9, 10, 11, 12, and 13 are in competition for the first year.
Nos. 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25 compete for local premiums.

## SPECIAL GRANTS.

£40 to the Highland Home Industries Association.—*Joint-Secretaries*, Miss Muriel K. Mackenzie, Conon House, Conon Bridge, Ross-shire, and Miss Jessie D. C. Ross, Riverfield, Inverness. Granted 1895. (Did not hold a Competition in 1899 or 1900.)

£20 to the Ayrshire Agricultural Association, to be competed for at the Dairy Produce Show at Kilmarnock —*Convener*, The Hon. G. R. Vernon, Auchans House, Kilmarnock; *Secretary*, John Howie, 58 Alloway Street, Ayr. Granted 1872.

£5 to Shetland Agricultural Society.—*Convener*, J. M Goudie, Lerwick; *Secretary*, James J Brown, Lerwick. Granted 1893.

£3 to Orkney.—*Convener and Secretary*, James Johnston, Orphir House, Orphir, Orkney. Granted 1883.

£3 to East Mainland, Orkney.—*Convener*, Alfred Reid, Braebuster, Kirkwall; *Secretary*, John Clouston, Graemeshall, Holm, by Kirkwall. Granted 1898

£3 to West Mainland, Orkney.—*Convener*, W. G. T. Watt, Skaill House, Stromness; *Secretary*, John Gibson, Seatter, Stromness, Orkney. Granted 1900.

£3 to Sanday, Orkney.—*Convener*, W. Cowper Ward, Scar House, Sanday, Orkney; *Secretary*, K. H. Sinclair, Kettletoft, Sanday, Orkney. Granted 1902.

£3 to Rousay, Orkney.—*Convener*, H. H. Horne, Trumland Farm, Rousay, Orkney; *Secretary*, Alexander Learmonth, Breckon, Rousay. Granted 1903.

£3 to South Ronaldshay and Burray, Orkney.—*Convener*, Arch. Allan, St Margaret's Hope, Orkney; *Joint-Secretaries*, William Cromarty, Widewall House, and Robert Cromarty, Sandwick House, St Margaret's Hope, Orkney. Granted 1904.

North of Scotland Root, Vegetable, &c.—*Convener*, John Maitland, East Balhalgardy, Inverurie; *Secretary*, James Eddie, F.R.H.S., Inverurie 4 Medals. Granted 1899.

£25 to Inverness Joint-Show.—*Secretary*, D. Gray, 36 Union Street, Inverness Granted for 1905 only.

## MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society, being anxious to co-operate with local Associations, will give a limited number of Silver Medals annually to Societies, not on the list of Cattle, Horse, or Sheep Premiums, in addition to the Money Premiums awarded in the Districts for—

1. Best Bull, Cow, Heifer of any pure breed, or Ox.
2. Best Stallion, Mare, or Gelding.
3. Best Tup, or Pen of Ewes or Wethers.
4. Best Boar, Sow, or Pig.
5. Best Pens of Poultry.
6. Best Sample of any variety of Wool.
7. Best Sample of any variety of Seeds.
8. Best managed Farm.
9. Best managed Green Crop.
10. Best managed Hay Crop.
11. Best managed Dairy.
12. Best Sweet-Milk Cheese.
13. Best Cured Butter.
14. Best Fresh Butter.
15. Best collection of Roots.
16. Best kept Fences.
17. Male Farm Servant who has been longest in the same service, and who has proved himself most efficient in his duties, and to have invariably treated the animals under his charge with kindness.
18. Female Servant in charge of Dairy and Poultry who has been longest in the same service, and who has proved herself most efficient in her duties, and to have invariably treated the animals under her charge with kindness.
19. Best Sheep-Shearer.
20. Most expert Hedge-Cutter.
21. Most expert Labourer at Draining.
22. Best Maker of Oat-Cakes.

It is left to the local Society to choose out of the foregoing list the classes for which the Medals are to be competed.

The Medals are granted for two years, and lapse if not awarded in those years.

In 1889 it was resolved that in future no Society shall receive more than two Medals for two years.

### *Aberdeenshire.*

1. Cluny.—*Convener*, Ranald R. Macdonald, 16 Union Terrace, Aberdeen; *Secretary*, James Christie, Backhill, Cluny, Kemnay. 2 Medals. 1905.
2. Echt, Skene, and Midmar.—*Convener*, A. C. Pirie of Dunecht, Aberdeenshire; *Joint Secretaries*, Alex. Ledingham and George Mowat, Dunecht, Echt, Aberdeenshire. 2 Medals. 1904.
3. Fyvie.—*Convener*, James Durno, Jackstown, Rothie Norman; *Secretary*, John Hay, Mill of Crichie, Fyvie. 2 Medals. 1905.
4. Strichen.—*Convener and Secretary*, John Sleigh, Strichen Mains, Strichen. 2 Medals. 1905.

*Ayrshire.*

5. MONKTON, NEWTON, PRESTWICK, AND ST QUIVOX.—*Convener*, Thos. C. Lindsay, Aitkenbrae, Monkton; *Secretary*, Hugh Boyd, jun., 2 Bute Place, Prestwick. 2 Medals. 1904.

*Dumfriesshire.*

6. SANQUHAR.—*Convener*, Robert Dalgleish, Ulzieside, Sanquhar; *Secretary*, Wm. Murray, British Linen Co. Bank, Sanquhar. 2 Medals 1905.

*Elginshire.*

7. STRATHSPEY.—*Convener*, James Allan; *Secretary*, D G. Lawson, Parish Council Office, Grantown. 2 Medals. 1905.

*Fifeshire.*

8. EAST OF FIFE.—*Convener*, ; *Secretary*; G. R. Fortune, Colinsburgh. 1 Medal. 1904.

*Stewartry of Kirkcudbright.*

9. GLENKENS.—*Convener*, A. F. M Spalding, Dalarran Lodge, New Galloway; *Secretary*, Rev. P. Philip, Manse of Kells, New Galloway. 2 Medals. 1905.

*Perthshire.*

10. MOULIN.—*Convener and Secretary*, Robert M'Gillewie, Union Bank, Dunkeld. 1 Medal. 1904.

*Renfrewshire.*

11. LOCHWINNOCH.—*Convener*, John Pollock, jun., Springside, Howwood; *Secretary*, Robert Reid, Writer, Lochwinnoch. 2 Medals. 1904.

*Ross-shire.*

12. LOCHBROOM.—*Convener*, Murdo Macleay, Broom Cottage, Lochbroom; *Secretary*, Hay Mackenzie, Banker, Ullapool. 1 Medal. 1904.

*Stirlingshire.*

13. GARGUNNOCK.—*Convener*, M. C Stark, Westerton Farm, Doune; *Secretary*, John Risk, Culmore, Kippen. 2 Medals. 1904.

Applications from other Districts must be lodged with the Secretary of the Society *by 1st November next.*

RULES OF COMPETITION.

1. All Competitions must be at the instance of a local Society.
2. The classes for which Medals are granted must be in accordance with the list at page 50. The Committee shall select the classes, and specify them in the return.
3. A Committee of Management shall be appointed, and the Convener of the Committee must be a Member of the Highland and Agricultural Society.
4. The Money Premiums given in the District must be not less than £2 for each Medal claimed.
5. The Medal for Sheep-Shearing shall not be awarded unless there are three competitors, and it shall always accompany the highest Money

Premium. There must not be fewer than two competitors in all the classes.

6. Blank reports will be furnished to all the Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary of the Highland and Agricultural Society *on or before the 1st of November next*, with the exception of green crop reports, which must be forwarded on or before the 20th of December, for the approval of the Directors, against whose decisions there shall be no appeal.

7. When a grant has expired, the District shall not be eligible to apply again for aid for two years; and if no competition takes place in a District for two years, the grant shall expire.

## PLOUGHING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first Premium at Ploughing Competitions, provided a Report in the following terms is made to the Secretary, within one month of the Competition, by a Member of the Society:—

### FORM OF REPORT.

I, of , Member of the Highland and Agricultural Society, hereby certify that I attended the Ploughing Match of the Association at in the county of on the when ploughs competed; of land were assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:—

[*Here enumerate the names and designations of successful Competitors.*]

### RULES OF COMPETITION.

1. All Matches must be at the instance of a local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society, 3 George IV. Bridge, Edinburgh.

3 Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match; and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve ploughs in Competition, and not less than Three Pounds awarded in Prizes by the local Society. The Medal to be given to the winner of the first prize.

7. Ploughmen shall not be allowed any assistance, and their work must not be set up nor touched by others; and attention should be given to the firmness and sufficiency of the work below more than to its neatness above the surface.

8. The Local Committee is required to fix the time to be allowed for ploughing the portion of land, and they are recommended that the time be at the rate of not more than ten hours per imperial acre on light land, and fourteen hours on heavy or stony land.

# CLASS III.

## COTTAGES AND GARDENS.

The following Premiums are offered for Competition in the Parishes after mentioned.

The Premiums are granted for two years.

### PREMIUMS FOR BEST KEPT COTTAGES AND GARDENS.

| | | | | |
|---|---|---|---|---|
| 1. | Best kept Cottage | £1 | 0 | 0 |
| | Second best | 0 | 10 | 0 |
| 2. | Best kept Cottage Garden | 1 | 0 | 0 |
| | Second best | 0 | 10 | 0 |

RULES OF COMPETITION.

1. Competitions may take place in the different parishes for Cottages and Gardens, or for either separately.

2. The occupiers of Lodges at Gentlemen's Approach Gates and Gardeners' Houses are excluded, as well as others whom the Committee consider, from their position, not to be entitled to compete. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judges

3. It is left to the Committee of the District to regulate the maximum annual rent of the Cottages, which may, with the garden, be from £5 to £7.

4. To warrant the award of full Premiums, there must not be fewer than three competitors in each class. If there are less than three competitors in each class, only half Premium will be awarded.

5. A person who has gained the highest Premium cannot compete again.

6. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is thatch, it must be in good repair, though in the occupation of a tenant. The interior and external conveniences must be clean and orderly; the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

7. In estimating the claims for the Garden Premiums, the judges should have in view—the sufficiency and neatness of the fences and walks; the cleanness of the ground; the quality and choice of the crops; and the general productiveness of the garden.

8. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary *on or before the 1st November next.*

9. When a grant has expired, the District cannot apply again for aid for two years.

Parishes desirous of these Premiums must lodge applications with the Secretary *on or before the 1st November next.*

## MEDALS FOR COTTAGES AND GARDENS OR GARDEN PRODUCE AND BEE-KEEPING.

1. The Society will give annually one or two Minor Silver Medals to a limited number of local Associations or individuals, who establish Competitions and Premiums for Cottages, Gardens, Garden Produce, or Bee-Keeping. The Medals will be granted for two years.

2. The Medals may be offered in any two of the following sections, *but under no circumstances will the two Medals be given in one of the sections:—*

(1) Best kept Cottage or best kept Cottage and Garden.
(2) Best kept Garden.
(3) Best Collection of Garden Produce (Flowers excluded).
(4) Honey.

3. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, must not exceed £15. The occupiers of Lodges at Gentlemen's Approach Gates, and Gardeners in the employment of others, are not entitled to compete.

4. If Competition takes place for Garden Produce, such produce must be *bona fide* grown in the Exhibitor's Garden. He will not be allowed to make up a collection from any other Garden. The produce must consist of Vegetables or Vegetables and Fruit—Flowers excluded.

5. The Honey must be the produce of the Exhibitor's own Hives.

6. To warrant the award of a Medal, there must not be fewer than three Competitors.

7. Blank forms for Reports of Competitions will be furnished to the Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary of the Highland and Agricultural Society *on or before the 1st November next*, for the approval of the Directors, against whose decisions there shall be no appeal.

8. When a grant has expired, the District cannot apply again for aid for two years, and if no competition takes place in a District for two years the grant expires.

9. Applications for these Medals must be made *before 1st November next.*

### *Dumfriesshire.*

1. KIRKPATRICK - FLEMING. — *Convener*, Charles Hogg, Woodhouse Cottage, Ecclefechan; *Secretary*, David Burnie, Hollee, Ecclefechan. 2 Medals. 1903. (No competition in 1903.)

### *Berwickshire.*

2. LAUDERDALE.—*Convener*, George Rankin, Lauder; *Secretary*, Alex. Kelly, jun., High Street, Lauder. 2 Medals. 1903. (No competition in 1904.)

### *Edinburghshire.*

3. CURRIE BEE-KEEPERS.—*Convener*, Rev. D. C. Stewart, The Manse, Currie; *Secretary*, Marshall Bryce, Currie. 2 Medals. 1903. (No competition in 1904.)

4. CURRIE.—*Convener*, Thos. B. Clark, Newmills, Balerno; *Secretary*, Marshall Bryce, Currie. 2 Medals. 1905.

*Fifeshire.*

5. DYSART.—*Convener*, James Orr, 10 Overton Road, Kirkcaldy; *Secretary*, Wm. Murray, 34 Union Street, Sinclairton. 2 Medals. 1904.
6. LESLIE.—*Convener*, Robt. Ritchie, Prinlaws, Leslie; *Secretary*, Andrew Dewar, Croft, Leslie. 2 Medals. 1904.

*Kinross-shire.*

7. BISHOPSHIRE.—*Convener*, ; *Secretary*, Andrew Mitchell, Schoolhouse, Scotlandwell, Leslie. 2 Medals. 1905.

*Stewartry of Kirkcudbright.*

8. URR AND DALBEATTIE.—*Convener*, James Biggar, Chapelton, Dalbeattie; *Secretary*, Q. Aird, Hardgate Schoolhouse, Dalbeattie. 2 Medals. 1904

*Lanarkshire.*

9. BIGGAR.—*Convener*, William Forrest, South Back Road, Biggar; *Secretary*, Wm. A. Low, Stanley Ville, Biggar. 2 Medals. 1904.
10. CAMBUSLANG HORTICULTURAL SOCIETY.—*Convener*, John Speir, Newton Farm, Newton, Glasgow; *Secretary*, J. M. Aitchison, 1 Morriston Street, Cambuslang. 2 Medals. 1904.
11. CARNWATH.—*Convener*, Thos Jackson, Carnwath; *Secretary*, Geo. C. Murray, Schoolhouse, Carnwath. 2 Medals. 1905.

*Orkney.*

12. ORKNEY.—*Convener*, Colonel Bailey, Dundas Crescent, Kirkwall; *Secretary*, George M. Louttit, County Buildings, Kirkwall. 2 Medals. 1905.

*Perthshire.*

13. BRACO.—*Convener*, James Macowan, Schoolhouse, Braco; *Secretary*, W. Macildowie, Crofthead, Braco. 2 Medals. 1905.
14. DUNNING.—*Convener*, Robert Gardiner, Henhill, Forteviot; *Secretary*, Johnstone Wright, Burnbank, Dunning. 2 Medals. 1905.

*Ross-shire.*

15. LEWIS.—*Convener and Secretary*, Major Duncan Matheson of Lewis, Lewis Castle, Stornoway. 2 Medals. 1905.
16. NOVAR AND DISTRICT.—*Convener*, R. C. Munro Ferguson of Novar, M.P., Evanton; *Secretary*, Alex. R. Munro, Newton of Novar, Evanton. 2 Medals. 1904.

*Stirlingshire.*

17. CAMPSIE.—*Convener*, Wm. R. Richmond, Mid-Muckcroft Cottage, Lennoxtown; *Secretary*, James Young, Crosshill Street, Lennoxtown. 2 Medals. 1905.

*Wigtownshire.*

18. NEWTON-STEWART, MINNIGAFF AND DISTRICT.—*Convener*, ; *Secretary*, Alex. S. Morton, Solicitor, Newton-Stewart. 2 Medals. 1905.

*SECOND EDITION.*]

**NOTE.—From 28th June till 7th July all communications should be addressed to the "Secretary's Office, Showyard, Glasgow."**

*Address for Telegrams*—"SOCIETY," EDINBURGH.

**Subject to Orders issued by the Board of Agriculture**

# HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

## GENERAL SHOW OF STOCK AND IMPLEMENTS,

## GLASGOW,

ON 4TH, 5TH, 6TH, AND 7TH JULY 1905

*LAST DAYS OF ENTRY.*

IMPLEMENTS AND OTHER ARTICLES—Monday, 1st May.

STOCK, POULTRY, AND DAIRY PRODUCE—Friday, 26th May.

No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Friday morning (26th May). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (31st May), at the Society's Office, Edinburgh, at 10 o'clock.

COVERED BOOTHS FOR OFFICES—Friday, 26th May

**President of the Society.**

THE RIGHT HON. THE EARL OF EGLINTON AND WINTON.

**Chairman of the Board of Directors.**

THE RIGHT HON. THE EARL OF MANSFIELD

**Convener of the Local Committee.**

R. SINCLAIR SCOTT, ESQ. OF BURNSIDE

**The District connected with the Show comprises the Counties of Lanark, Ayr, Argyll, Renfrew, and Bute.**

## REGULATIONS.

### GENERAL CONDITIONS.

1. The Competition, except where otherwise stated in the Premium List, is open to Exhibitors from all parts of the United Kingdom.

2. Every Lot must be intimated by a Certificate of Entry, lodged with the Secretary *not later than Monday, 1st May, for Implements and other* *Entries.*

*Articles, and Friday, 26th May, for Stock, Poultry, and Dairy Produce.* No Entry taken at ordinary fees later than those which are received at the Society's Office by first post, or 10 o'clock, on Friday morning, 26th May. Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (31st May), at the Society's Office, Edinburgh, at 10 o'clock. Printed forms of Entry will be issued on application to the Secretary, No. 3 George IV. Bridge, Edinburgh. Admission Orders for Exhibits and Attendants will be forwarded to Exhibitors, by post, previous to the Show.

*Licences for moving Stock.* 3. This Premium List is published and the Show will be held subject to any Orders that may be issued by the Board of Agriculture or Local Authorities. Any licenses that may be required for the movement of Stock into or away from the Show must be obtained by Exhibitors. For licenses or forms, to be obtained for this Show, application should be made to James Caldwell, Esq., County Clerk, Paisley.

4. No Entry can be received or recorded unless it is accompanied by the necessary fees, and complies fully with the Regulations in the Premium List.

*Particulars of Entries.* 5. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor. The Society shall have power at any time to call upon an Exhibitor to furnish proof of the correctness of any statement in his entry.

6. The name of the Breeder, if known, must be given, and if the Breeder is not known, a declaration to that effect, signed by the Exhibitor, must be made on the Entry Schedule, and no pedigree will be entered in the Catalogue when the Breeder is unknown.

*No substitution of Animals.* 7. All animals, except calves, foals, and lambs shown with their dams, must be entered in the classes applicable to them, and cannot be withdrawn after entry, or other animals be substituted in their place.

*One Class only.* 8. For prizes given by the Society, no animal shall be allowed to compete in more than one class, or to compete in any class except that prescribed for animals of its pedigree and description; but this Rule does not apply to the Jumping and Driving Competitions.

*Ownership.* 9. All stock exhibited at the Show, except where otherwise stated in the Premium List, must be from the time of entry to the date of the competition the *bona fide* property of the Exhibitor in whose name it is entered.

*Responsibility for Entries.* 10. Exhibitors are alone responsible for the accuracy and eligibility of their entries The entry-fee paid for an animal entered in a class for which it is not eligible is not returnable.

*Society not liable.* 11. The Society shall not be liable for any loss or damage which Stock, Poultry, Dairy Produce, Implements, or other articles may sustain at the Show, or in transit.

*Disqualified Exhibitors.* 12. The Society reserve to themselves the right of refusing, cancelling, or prohibiting the exhibition of entries from any person who, after 1st January 1904, has been expelled from the membership of any Agricultural or Dairy Society, or who may have been prohibited, suspended, or disqualified from making entries or exhibiting at the Show or Shows of any Agricultural or Dairy Society or Breed Society in consequence of having attempted to obtain a Prize by giving a false Certificate, or by other unfair means, or who is under exclusion from any Breed Society for fraudulent practices.

*Animal disqualified.* **13. When an animal has previously been disqualified by the decision of any Agricultural Society in the United Kingdom, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity.**

14. Any artificial contrivance or device of any description found on or proved to have been used on an animal, either for preventing the flow of milk or for any other improper purpose, will disqualify that animal from being awarded a Premium, and the Owner of said animal may be prohibited from again entering Stock for any of the Society's General Shows, for such a period as the Directors may see fit. *Tampering with Animals.*

15. The Society further reserve to themselves the right of refusing any other entries they may think fit to exclude, or to cancel any entry made, or to prohibit the exhibition of any entry. *Rejecting Entries.*

16. Stock entered for competition, and actually in the Show, is subject to the control and under the orders of the Stewards, Secretary, and other Show officials of the Society, and such stock may not be withdrawn from competition without the consent of the Stewards or Secretary. *Control of Exhibits.*

17. Persons making insulting remarks to, or in any way unduly interfering with, the Judges, Stewards, or other officials while in the performance of their duties, and all Exhibitors or others in charge of stock while in the judging rings refusing to accept or display tickets, rosettes, &c., awarded by the Judges, and handed to them by the Stewards or other officials, or tearing up tickets, rosettes, &c., so awarded and handed to them, or of any similar conduct, shall be considered guilty of misconduct, and shall be dealt with under these rules *Improper Conduct.*

18. All persons in charge of stock or other exhibits, and all persons admitted into the Showyard, shall be subject to the rules of the Society, and shall obey the orders of the Stewards, Secretary, and other officials of the Society. Exhibitors shall be answerable for the conduct of their servants or representatives. *Subject to Orders.*

19. The Stewards and other officials have power to enforce the regulations of the Society in their different departments. *Power of Officials.*

20. A protest having reference to exhibits at the Show may be lodged by any person having interest. Protests having reference to competitions which take place on the first day of the Show must be lodged in writing with the Secretary at his Office in the Showyard not later than 9 A.M. on Wednesday, the second day of the Show, and parties must be in attendance at the Secretary's Office in the Showyard at 9.30 A.M. that day, when protests may be disposed of. Protests relating to competitions taking place after the first day of the Show must be lodged before 5 P.M on the day on which the particular exhibition takes place. Each protest must state specifically the grounds of objection, and must be accompanied by a deposit of £2, 2s., which deposit may, if the objection be proved frivolous to the satisfaction of the Directors, be forfeited. Protests may be lodged at any time by Directors, and in this case no deposit will be required. Protests will be heard and determined by the Directors. *Protests.*

21. The violation of any one of the regulations, or disobedience of the orders of the Directors, Stewards, Secretary, or other officials of the Society, shall render the offending person liable to the forfeiture of all premiums awarded to him, or of such a portion as the Directors may ordain, and also liable to be expelled from the membership of the Society, and disqualified from again, or for a certain number of years, exhibiting at the Shows of the Society, or to have his case disposed of by fine or otherwise as the Directors may determine. *Penalties for Offences.*

22. The decision of the Directors shall, in the case of protests made in virtue of Regulation 9 hereof, and in every other matter arising at or in connection with the Show, be final, and every person present at the Show, whether as a Judge, Exhibitor, Visitor, or otherwise, shall be deemed thereby to have agreed to refer the subject-matter of such decision to the final determination of the Directors, to the exclusion of all Courts of Law. *Final Authority.*

*Intimating Decisions.* 23. All decisions under these rules may, along with the names and addresses of the persons against whom such decisions have been pronounced, be communicated by the Secretary of this Society to the Secretaries of all Agricultural or Dairy Societies holding open Shows in the said United Kingdom, and to the Secretaries of all Breed Societies in said United Kingdom, and may be published in the Annual Reports of this Society, and in such newspapers or journals as the Directors may determine; and every Exhibitor competing at the Show, and every person present at the Show, whether as a Director, Member of Committee, Steward, Judge, Exhibitor, Visitor, or otherwise, shall be deemed thereby to have consented to such communication and publication.

*Former Winners.* 24. An animal which has gained a first Premium, or which subsequently becomes entitled to a first Premium, at a General Show of the Society cannot again compete in the same class, notwithstanding any alteration in the heights stated for such class, but may be exhibited as Extra Stock.

*Herd-books.* 25. Shorthorn, Aberdeen-Angus, Galloway, and West Highland animals must be entered in the herd-books, or the Exhibitor must produce evidence that his animal is eligible to be entered therein.

*Height of Horses.* 26. All Horses or Ponies entered in classes in which a particular height is stated shall before being judged be measured with their shoes on. No subsequent measuring or alteration of shoes will be permitted.

*Overfeeding.* 27. Breeding Stock must not be shown in an improper state of fatness, and the Judges are requested not to award Premiums to overfed animals; and no Cattle or Sheep which after the age of twelve months have been exhibited as Fat Stock at any Show are eligible to compete in the Breeding Classes for the Society's Prizes.

*Sires.* 28 Aged Bulls and Stallions must have had produce, and, along with two-year-old Bulls, three-year-old Colts, and two-shear and aged Tups, have served within the twelve months immediately preceding the Show.

*Cows.* 29 Except as may be otherwise specially provided, cows of all breeds must have had a calf within nine months previous to the Show, and when exhibited must be in milk. Animals of any age that have had a calf must be shown as Cows.

*In-calf Heifers.* 30. Two-year-old Heifers of the Shorthorn, Aberdeen-Angus, and Galloway breeds, two-year-old Yeld Ayrshire Heifers, and three-year-old Highland Heifers, must be in calf when exhibited, and the Premiums will be withheld till birth be certified, which must be within 9 months after the Show.

*Mares.* 31. A Mare entered in a class for "Mares with foal at foot" must have produced a foal after 1st January of the year of the Show, must have regularly nursed her own or another foal, and must have the foal with her in the Show. If the mare's own foal is alive it must be the foal shown with the mare. In the case of a Mare that has not foaled before the Show, or whose foal has died, she shall, if not in milk, be eligible without further entry to compete among the Yeld Mares. Agricultural Yeld Mares must produce a foal within 12 months from the first day of the Show. A Mare in a class for "Mares or Geldings" may or may not have had a foal in the year of the Show, but shall not have her foal exhibited with her, nor be in milk at the time of the Show.

*Calves and Foals.* 32. With reference to Regulation 30, birth of at least a seven months' calf must be certified; and in regard to Regulation 31, birth of at least a nine months' foal; or in the case of the death of the dam, a Veterinary Surgeon's certificate must be produced certifying that at the time of death the animal was so far advanced with calf or foal that if it had lived it would have produced a calf or foal, as required by Rules 30 and 31. *Calving and Foaling Certificates.* Certificates of calving required by the foregoing Regulations must reach the office of the Secretary within ten months of the last day of the

Show; foaling certificates within thirteen months of the last day of the Show. In default of this, the animal will be regarded as having failed to fulfil the Regulations, and the prize will therefore be forfeited.

33. Except when otherwise provided, the awards of Special Prizes shall not be subject to the Regulations as to calving and foaling. *Special Prizes.*

34. The Premiums awarded, except those withheld till birth of calf or foal is certified, will be paid as soon after the Show as practicable, and, with the exception of the Tweeddale Gold Medal, Special Cups, and Medals, may be taken either in money or in plate. *Payment of Prizes.*

35. In the classes for Hunters Judges are empowered to transfer to the proper classes horses which, in regard to weight-carrying, are in their opinion entered in the wrong classes. *Hunters.*

36. Judges are particularly requested to satisfy themselves, as far as possible, regarding the soundness of all Horses before awarding the Prizes, and to avoid giving Prizes to animals showing symptoms of hereditary diseases. The Judges may consult the Society's Veterinary Surgeon if they deem it expedient. No protests on veterinary grounds will be received. *Soundness of Horses*

37. All Ewes must have reared lambs in the year of the Show; and Ewes of the Blackfaced and Cheviot breeds must be in milk, and have their lambs at foot. *Ewes.*

38. Sheep must have been clipt bare after 1st January of the year of the Show, and the Judges are instructed to examine the fleeces of the Sheep selected for Prizes, and to cast those on which they find any of the former fleece. This Rule does not apply to Cheviot sheep. *Clipping.*

39 Sows must have reared pigs in the year of the Show or be in pig; and Pigs must belong to the same litter, and be uncut. *Sows.*

40. In Poultry the Aged Birds must have been hatched previous to, and Cockerels and Pullets in, the year of the Show. *Poultry.*

41. Railway Certificates for Stock and Implements are issued to Exhibitors before the Show along with their Tickets of Admission, one Certificate for the outward and another for the return journey being sufficient for each Exhibitor for any number of exhibits. *Railway Passes.*

42 Poultry and Stock will be admitted on Monday, the day before the opening of the Show, and, with the exception of Horses, must be in the Yard before 12 o'clock that night. Horses must be in before 8 o'clock on the morning of Tuesday, except those entered in classes for which other times for arrival are elsewhere stated in this List. Judging begins at 10 A.M. on Tuesday. Exhibited on Tuesday, Wednesday, Thursday, and Friday. Stock may be admitted on the Saturday preceding the Show, but only by sending two days' prior notice to the Secretary. *Admission of Stock.*

43. Horses and Cattle must be paraded at the times stated in the Programme of the Show, and when required by the Stewards, and under their direction. In Parade, Horses must be ridden or led as provided in their respective classes. Prize and commended Cattle and Horses will receive two rosettes each, which must be attached to the head of the animal, one on each side. Attendants must be beside their animals *twenty minutes before the hour of Parade*, and be ready to proceed to the ring immediately on receiving the order of the Stewards. Infringement of this Rule, or failure of any attendant to obey the orders of the Society's officials, will render the Exhibitor liable to a fine of 20s. for each separate infringement or act of disobedience, and to the forfeiture of any or all of the Prizes awarded to him at this Show. *Parades.*

44. Exhibitors shall be answerable for all acts, whether committed by themselves, their servants, or others in charge of their Stock, and shall be responsible for the condition of their animals during the whole time they remain in the Showyard. *Responsibility of Exhibitors.*

*Moving from stalls.* 45. No animal shall be taken out of its stall after 10 A.M. during the Show except by order of the Stewards, or with permission of the Secretary.

*Washing Cattle.* 46. Cattle shall not be taken out of their stalls to be washed after the Judging has been finished. Those infringing this Rule shall be liable to a fine of 10s.

*Soaping prohibited.* 47. Soap or other adhesive material must not be used in dressing cattle or horses. Infringement of this Rule will render the animal upon which the material is used liable to be disqualified.

*Accommodation for Animals.* 48. Loose-boxes will be provided for Stallions, three-, two-, and one-year-old entire Colts; for two- and one-year-old Fillies, and for Mares with foals at foot; closed-in stables for all the other Horses, and covered accommodation for the whole of the other Live Stock. In no case, either in the ordinary classes or "Extra Stock," will a box be provided except for the classes here specified. Stalls (floored) for attendants on Cattle, Horses, and Sheep will be provided at same rates as those charged for Stock. *Floored stalls for Animals.* Exhibitors requiring floored stalls for their animals must give notice to the Showyard contractor, Mr Farquhar, Showyard, ten days before the Show opens.

*Securing Cattle.* 49. Bulls must be secured by nose-rings, with chains or ropes attached, or with strong halters and double ropes. All Cattle, other than Highland Cattle, must be tied in their stalls.

*Concealing Animals.* 50. During the time the Show is open to the public no rug shall be hung up so as to conceal any animal in a horse-box or stall, except with the special permission of the Steward of that department.

*Fodder.* 51. Five days' supply of straw, hay, grass, and tares will be provided free by the Society. Any additional fodder or other kinds of food required will be supplied at fixed prices in the Forage-yard. Any servant removing bedding from an adjoining stall will be fined in double the amount taken. Exhibitors may fetch their own cake or corn to the Yard, but not grass, tares, hay, or straw. Coops, food, and attendance for Poultry will be provided by the Society.

*Feeding appliances.* 52. Servants in charge of Stock must bring their own buckets or pails, and a piece of rope or sheep-net to carry their forage. Mangers, sheep and pig troughs, will be provided.

*Sawdust.* 53. Sawdust must not be used as bedding for Stock.

*Water.* 54. As the command of water in the Yard is limited, it is particularly requested that waste be avoided.

*Lights and Smoking.* 55. No lights allowed in the Yard at night, and Smoking is strictly prohibited within the Sheds. Those infringing this Rule shall be liable to a fine of 10s.

*Removal of stock.* 56. Cattle, Sheep, Swine, or Poultry cannot be removed from the Yard till 5 P.M. on Friday, the last day of the Show, except on certificate by the Veterinary Surgeon employed by the Directors, countersigned by the Steward of the department or the Secretary.

*Withdrawal of horses over night.* 57. At the close of the Show on Tuesday, Wednesday, and Thursday, horses may be withdrawn for the night on a deposit of £5 for each animal, which shall be forfeited, along with any prize money it may have gained, if the animal is not brought back. They must return between 7 and 7.30 the following morning, and those not in before 8 shall forfeit 10s. Horse passes to be applied for at the Secretary's Office between 5 and 6 P.M. on Tuesday, and the deposit, unless forfeited in whole or in part, will be returned between 12.30 and 2.30 on Friday.

*Order in removal.* 58. When the Stock is leaving the Yard, no animal is to be moved till ordered by those in charge of clearing the Yard. Those transgressing this Rule shall be liable to a fine of 10s., and detained till all the other Stock is removed.

*Penning and* 59. Poultry may be penned before the opening and removed at the close of the Show by Exhibitors themselves or their representatives.

In the event of neither the Exhibitor nor an authorised representative of the Exhibitor being present to pen or remove Poultry, the birds will be penned and removed by men hired and paid by the Society, but this will be done on the understanding that the men are hired to do the work on behalf of Exhibitors, and solely at their risk, and that the Society will be in no way responsible for expenses incurred or loss of or injury to Exhibits by errors or accidents in penning, despatching, or conveying Exhibits. *removing Poultry.*

60. On the opening day of the Show the Poultry Shed will be closed to the public during the Judging. On the last day of the Show the Poultry Shed will be closed to the public at 4 P.M.; at 5 P.M. Exhibitors or their representatives will be admitted to the Shed to remove Exhibits, provided the Exhibitor has, *not later than* 11 A.M. *on the last day of the Show*, given written notice to the Secretary to the effect that the Exhibitor or the Exhibitor's representative will attend at the Poultry Shed at 5 P.M. to remove the birds. *Closing of Poultry Shed.*

## JUDGING STOCK AND POULTRY.

61. On Tuesday, the first day of the Show, no person will be admitted, except Servants in charge of Stock, till 8 A.M., when the Gates are opened to the public. *Opening Gates.*

62. The Judges will commence their inspection at 10 A.M. The spaces reserved for the Judging will be enclosed, and no encroachment shall be permitted. *Judging.*

63. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit; and where only one or two lots are presented in a section, and the Judges consider them unworthy of the Premiums offered, it shall be in their power to award a lower prize, or to suggest the removal of any lot which appears to them unworthy of a place in the Yard. *Insufficient merit.*

64. In addition to the Premiums, the Judges are authorised to award three Commendations in each section, if the entries are numerous and the animals of sufficient merit. These Commendations consist of—Very Highly Commended, Highly Commended, and Commended. *Commendations.*

65. Ayrshire Cows which have not calved before the Show, whether entered in the class for Cows in Milk or for Cows in Calf, shall be judged along with the Cows in Calf, and Ayrshire Cows or Heifers which have calved before the Show—in whichever of the two classes entered—shall be judged along with Cows in Milk. *Ayrshire Cows and Heifers.*

66. Attending Members will accompany each section of the Judges. It will be the duty of Attending Members to bring the animals out to the Judges and to see that no obstruction is offered to them, and that the space reserved for them is not encroached upon; to ticket the prize animals; to send the Nos. of prize animals to the Award Lectern near the Secretary's office; to assist the Judges in completing their return of awards; and should any difficulty arise, to communicate with the Stewards or Secretary. *Attending Members.*

67. It shall not be competent for any Exhibitor, nor for his Factor or Land-Steward, to act as a Judge or attending Member in any class in which he is competing.

## DAIRY PRODUCE.

68. Dairy Produce will be received in the Showyard on Monday, the day before the opening of the Show, and till 8 A.M. on Tuesday, the first day of the Show. Judged at 10 A.M. on Tuesday. Exhibited Tuesday, Wednesday, Thursday, and Friday.

69. Dairy Produce must have been made on the Exhibitor's farm this year. No Exhibitor shall show more than one lot in each class. No lot

can be removed from the Yard till 5 P.M. on Friday, the last day of the Show. The Society undertakes no responsibility for the receipt or despatch of exhibits, nor for the loss of exhibits, nor for any injury they may sustain during the Show.

## STALL RENT (INCLUDING ENTRY FEE).

70. The following rates (which include Entry Fees and Stall Rent) shall be paid by Exhibitors when making their Entries :—

| | Members s. | Members d. | Non-Members s. | Non-Members d. |
|---|---|---|---|---|
| Stalls for Cattle, each | 15 | 0 | 25 | 0 |
| Ayrshire Cows in milk and in calf (enclosed stalls) | 25 | 0 | 35 | 0 |
| Boxes for Horses in Classes 33, 34, 35, 40, 54, 55, 56, 60, and 61 | 30 | 0 | 40 | 0 |
| Boxes for Horses in Classes 36, 43, 44, 46, 47, 58, 59, 62, 63, 64, 65, 69, 72, 73, 75, 76, and 77 | 22 | 6 | 32 | 6 |
| *Stalls for Horses in Classes 37, 38, 39, 41, 42, 48, 49, 50, 51, 52, 53, 57, 80, 81, 82, 83, 84, and 85 | 20 | 0 | 30 | 0 |
| Stalls for Ponies in Classes 66, 67, 68, 70, 71, 74, 78, and 79 | 15 | 0 | 20 | 0 |
| Entries in Classes 45 and 86, without stalls | 5 | 0 | 10 | 0 |
| Shed Accommodation for Machines for driving competitions, each | 5 | 0 | 10 | 0 |
| Sheep or Swine, per pen | 10 | 0 | 15 | 0 |
| Poultry, each entry | 2 | 0 | 3 | 0 |
| Dairy Produce, each entry | 4 | 0 | 6 | 0 |
| Covered Booths for offices, 9 feet by 9 feet | 70 | 0 | 100 | 0 |
| Newspaper offices . . £2, 10s. | | | | |

*Entries in more than one Class*.—In the case of animals entered in more than one class, the entry fee, whether for Post or other Entries, shall be five shillings for each class after the first. This does not apply to the Jumping Competitions.

## EXTRA STALL FOR ATTENDANTS.

71. Exhibitors of Stock shall be entitled to take an extra Stall or Box for the accommodation of their attendants, but they must state when making their Entry that the Stall or Box is to be used for that purpose, and remit rent, which is at the same rate as stated above for the particular class of stock. They must also state next to which animal they wish the attendant's accommodation to be placed.

## IMPLEMENTS AND OTHER ARTICLES.

*Admission.* 72. Implements will be received in the Yard from Tuesday, 27th June till 5 o'clock on the afternoon of Monday, 3rd July. Exhibited Tuesday, Wednesday, Thursday, and Friday. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor, and prices must be stated.

*Premiums.* 73. No Money Prizes or Medals, except when specially offered, will be given by the Society for Implements of any kind.

*Refusing Entries.* 74. Agricultural Implements, and Implements and collections of articles not Agricultural, will be received for Exhibition, but the Secretary is entitled to refuse Entries from dealers in articles not deemed worthy of Exhibition.

* In case of Pairs double entry fee must be paid.

75. In order to encourage exhibits of Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show, open space will be provided for these in some less prominent part of the Yard at a charge of 10s. for space 10 feet wide and 20 feet deep. *Local Operatives*

76 Implements will be entered in the following sections—viz., 1st, Space without Shedding, 20 feet deep; 2nd, Shedding, 20 feet deep, 7 feet high to eave; 3rd, Shedding, 20 feet deep, 7 feet high to eave, boarded at back; 4th, Motion Yard, without Shedding, 50 feet deep; 5th, Motion Yard, 50 feet deep, with Shedding, 20 feet wide, 10 feet high to eave; 6th, Open space for Agricultural Implements from operative Blacksmiths and Carpenters in the district of the Show. Exhibitors must specify the space they require. *Order of Implements.*

77. Every article to be exhibited must be entered on the Society's Entry Form. Any article not so entered that is taken to the Show is liable to be ordered out of, or removed from, the Showyard, or confiscated to the Society. Exhibitors infringing this rule are moreover liable to a fine of £1. *Articles not entered.*

78. "Cheap-Jacks" are not admitted to the Showyard. The selling of goods by auction, shouting, and other behaviour calculated to annoy visitors or Exhibitors, are strictly forbidden. Exhibitors infringing this Regulation are liable to a fine of £1, and to have themselves and their goods ordered out of, or removed from, the Showyard, or to have their goods confiscated to the Society. *Selling by auction and noisy behaviour forbidden.*

79. The articles of each Exhibitor must be all placed in one stand, except Implements in motion, and must not on any account extend beyond the allotted space. No article shall be moved out of its stand, or the stand dismantled, till the termination of the Show, at 5 P.M. on Friday. Those infringing this Rule shall be liable to a fine of 10s. *Placing Exhibits. Removing Exhibits.*

80. When the ground requires to be broken, the turf must be carefully lifted and laid aside, and the surface must be restored to the satisfaction of the Society, and at the expense of the Exhibitor. Failing this being done, the Society shall be at liberty to restore the ground and charge the cost to the Exhibitor. *Restoring Turf.*

81. Exhibitors must arrange their own articles *within* the space allotted to them before 9 o'clock on Tuesday, and to the satisfaction of the Stewards in charge of the Implement Yard. Exhibitors are prohibited from subletting space allotted to them. *Arranging Exhibits.*

82. Exhibitors are not allowed to distribute handbills anywhere in the Yard except at their own Stand; and they must not for this or any other purpose encroach upon the adjacent alleys or open spaces. *Handbills.*

83. Exhibitors are required to have their Stands and the portions of the alleys immediately adjoining them swept up before eight o'clock on each morning of the Show. *Sweeping Stands, &c.*

84. All Machines requiring steam or fire must be entered as such in the Certificate, and will be placed in the Motion Yard. *Coke only shall be used in all cases where fire is required.* Coal shall not be used at any time in the Showyard. Those infringing this Rule shall incur a penalty of £5. *Fuel.*

85. No Steam Engine shall be driven in the Yard at a greater speed than 4 miles an hour. Traction Engines shall not be used in conveying Exhibits or other goods into, from one place to another in, or out of the Showyard. *Steam Engines.*

86. Locomotive and Traction Engines and other Machines must not be moved from their places without permission of the Secretary or Stewards, and must not leave their stands till 6 P.M. on Friday.

87. There must be attached to each Implement, when forwarded to the Show, a label bearing the Exhibitor's name, and that of the Implement, as well as the number of the Exhibitor's stand. *Consigning Implements.*

88. The carriage of all Implements must be prepaid.

*Photographing in Showyard.* 89. Photographing in the Showyard is not permitted, except by photographers having a Stand in the Showyard or holding a "Photographer's Ticket." The "Photographer's Ticket" may be had from the Secretary, price 15s. It admits the holder to the Show when open to the public, and entitles him to photograph in the Showyard, subject to arrangements made by the Stewards.

*Covered Booths.* 90. Covered Booths for Offices (9 feet by 9 feet), purely for business, not for exhibition of goods, can be had for £3, 10s. to Members and £5 to Non-Members. Intimation to be made to the Secretary on or before the 26th May. Those applying after that date to pay double Entry Money, but no application can be received later than 31st May.

*Exhibitors' and Attendants' Tickets.* 91. Each Exhibitor in the Implement Department who is not a Member of the Society will receive one free Ticket of Admission to the Showyard for himself or a member of his firm, and will receive, in addition, for the use of attendants employed by him at his Stand, two Tickets of Admission for each complete ten feet of shedding in the Motion Yard, and one Ticket for each complete ten feet of shedding in the other sections. No additional Free Tickets can be issued in any circumstances whatever. Additional Attendants' Tickets, not more than five for any one Exhibitor, may be purchased at 5s. each.

*Tickets to be filled up and signed.* 92. The Tickets of Admission for Exhibitors and Attendants referred to in the foregoing Regulation will (about fourteen days prior to the Show) be issued to the Exhibitors in blank, with the number of the Exhibitor's Stand. The name of the person for whom each ticket is intended must be written on it before it is used. Each person holding a Free Ticket of Admission must sign his or her name on the back thereof, and must also, when required, sign his or her name in the book at the Entrance Gate. *Tickets not Transferable.* Exhibitors' attendants are strictly cautioned not to lend or transfer their Tickets, which can be used only by the persons whose names they bear, and who must be *bona fide* acting for, or employed by, the Exhibitor. *Improper use of Tickets.* No Ticket is transferable. An Exhibitor is liable to a fine of £1 for each case of transfer or other improper use of a Ticket issued to himself or employee.

## STALL RENT.

93. Ground to be taken in spaces of 10 feet frontage by 20 feet deep, except in Motion Yard, which is to be 10 feet or any larger amount of frontage by 50 feet deep. Exhibitors must take their space wholly covered or wholly open. Space is not let partly covered and partly open.

94. Rates for space, payable by Exhibitors when making their Entries:—

| | Members. | Non-Members. |
|---|---|---|
| Space without Shedding, 20 feet deep, per 10 feet . | £1 5 0 | £1 15 0 |
| Shedding, 20 feet deep, 7 feet high to eave, per 10 feet | 1 5 0 | 1 15 0 |
| Shedding, 20 feet deep, 7 feet high to eave, *boarded at back*, per 10 feet . . . . . . | 1 12 0 | 2 2 0 |
| Space in Motion Yard, without Shedding, 50 feet deep, per foot . . . . . . | 0 5 0 | 0 8 0 |
| And with Shedding, 20 feet deep, 10 feet high to eave, per foot . . . . . . . | 0 7 0 | 0 10 0 |
| Covered Booths for offices, 9 feet by 9 feet, each . | 3 10 0 | 5 0 0 |
| Newspaper offices, each . . £2, 10s. | | |

## ALLOCATION OF SPACE FOR IMPLEMENTS.

NOTE.—*On account of the fact that the limited extent of the Showyard will afford considerably less space than usual for the Exhibition of Implements, the Directors are reluctantly compelled to intimate that they reserve the right to allot to each Exhibitor either the whole of the space applied for or such smaller area as they may find available.*

## ADMISSION OF THE PUBLIC.

The public will be admitted daily at 8 A.M. Judging begins on Tuesday at 10 A.M. The charges for admission to the Yard will be— Tuesday, from 8 A.M. till 5 P.M., 5s. Wednesday, from 8 A.M. till 5 P.M., 3s.; from 5 P.M. till 8 P.M., 1s. Thursday, from 8 A.M. till 5 P.M., 2s.; from 5 P.M. till 8 P.M., 1s. Friday, from 8 A.M. till 5 P.M., 1s.

## ADMISSION OF MEMBERS AND EXHIBITORS.

On exhibiting their "*Member's Ticket,*" which is strictly not transferable, Members of the Society are admitted free to the Showyard and to the Enclosures and Stands around the Large Ring, excepting the Reserved Seats in the Grand Stand, and such other parts as may be reserved for any special purpose. Tickets will be sent to all Members residing in the United Kingdom whose addresses are known, and on no account will duplicates be issued. **All Members not producing their tickets must pay at the gates, and the admission money will not on any account be returned.** Tickets must be signed by Members before being presented at the gate.

Tickets of admission to the Showyard are sent to Exhibitors of Stock, Poultry, and Dairy Produce (not Members) whose Entry Fees amount to not less than 10s.

For Exhibitors of Implements and their assistants tickets are issued as provided in the Regulations for Implements.

## RESERVED SEATS IN GRAND STAND.

*For Charges, apply to Secretary.*

## VARIOUS.

Placards, except those of the Society, are prohibited both inside the Showyard and on the outside of the Boundary Fence, with the exception of those belonging to Exhibitors, whose right is confined to their own stalls. No newspapers or any other article allowed to be carried about the Yard for sale or display. No strolling bands or musicians admitted.

*No Carriages or Equestrians admitted without special leave from the Directors, and then only for Invalids. Bath-chairs may be brought in.*

Premium Lists, Regulations, and Certificates of Entry may be obtained by applying at the Secretary's Office, No. 3 George IV. Bridge, Edinburgh.

*All Communications should be addressed to* JAMES MACDONALD, Esq., *Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh. From 28th June to 7th July to the Secretary's Office, Showyard, Scotstoun, Glasgow.*

*Address for Telegrams*—"SOCIETY," EDINBURGH.

## LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Monday, 1st May.

STOCK, POULTRY, AND DAIRY PRODUCE—Friday, 26th May.

**No Entry at ordinary fees taken later than those which are received at the Society's Office, Edinburgh, by first post, or 10 o'clock, on Friday morning (26th May). Post Entries for Cattle, Horses, Sheep, and Swine taken on payment of 10s. additional for each entry (Poultry at double fees) till Wednesday morning (31st May), at the Society's Office, Edinburgh, at 10 o'clock.**

COVERED BOOTHS FOR OFFICES—Friday, 26th May.

## RAILWAY ARRANGEMENTS.

The Railway Companies will be furnished with a list of the Exhibitors of Stock and Implements, after the 16th June. All applications for horse-boxes and trucks, and for information as to arrangements of Special Trains, must be made by the Exhibitors themselves to the Stationmaster where their stock is to be trucked.

*The arrangements made by the Railway Companies for the conveyance of Live Stock and Goods to and from the Show are* **indicated** *below, but exhibitors are recommended to apply to the respective companies for* **full particulars** :—

1. Live Stock and Goods *to* the Show to be charged ordinary rates.
2. Live Stock and Goods *from* the Show, *if sold*, to be charged ordinary rates.
3. Live Stock and Goods *from* the Show, *if unsold*, to be carried at half rates back to the station whence they were sent, at owners' risk, on production of a certificate from the Exhibitor to the effect that they are really unsold; failing production of such certificate, ordinary rates must be charged. The reduction to half rate is to be allowed only when the animals or goods are returned by the same route as that by which they were conveyed *to* the Show. The minimum charge for Stock returned at half rates will be one-half the ordinary minimum.

*If the unsold Live Stock which was carried on the outward journey by Passenger Train in horse-boxes be required to be returned by Goods Train in cattle trucks, half the Goods Train rates must be charged.*

*If the unsold Live Stock which was carried on the outward journey by Goods Train in cattle trucks be required to be returned by Passenger Train in horse-boxes, half the Passenger Train rates must be charged.*

4. Horses and Cattle, when sent for exhibition from one Agricultural Show to another, in another part of the country, are charged the ordinary single rates in respect of each journey, from point to point, up to the last station to which they are sent for exhibition. If remaining unsold when returned from the latest Show to the originating or home station, they are—on production of the necessary certificates—charged half rates, provided such return journey is made by the line of the company by whose route it was conveyed on the outward journey, and provided the railway traversed was covered on the outward journey. If conveyed by Goods Train, Unsold Live Stock transferred from one Agricultural Show to another in another part of the country must be charged ordinary rates.
5. Unsold goods, previously carried by railway, transferred from one Agricultural Show to another, in another part of the country, will be conveyed at half rates at owners' risk, on production of certificate from the Exhibitor to the effect that they are unsold ; failing production of such certificate, ordinary rates will be charged.
6. Poultry to be charged ordinary rates both ways, and will not be accepted for conveyance unless the carriage charges are prepaid.
7. Horse-boxes, or other Passenger Train vehicle, will not be provided for the carriage of Live Stock sent by Goods Train and invoiced at Goods Train rates. *For rates for Horse-boxes by Passenger and Special Trains, apply to the Railway Companies.*
8. Provender conveyed to Agricultural Shows with Live Stock will be charged ordinary rates, except so much of the same as may be required on the journey.
9. Men, certified by the owners to be *bona fide* in charge of Live Stock, to be conveyed free in the same train as the animals, as follows: One man for each consignment, except where the consignment requires more than one vehicle, when one man for each vehicle may be sent free ; but no pass is given unless the charge for the consignment amounts to as much as the charge for one horse. When two or three horses forming one consignment are sent in the same horse-box, and a man is required to travel with each animal, the men may be conveyed free, provided each horse is charged at the single horse rate. Upon both the outward and homeward journeys a separate certificate and contract must be given, which must be retained by the stationmaster at the outward or homeward starting-point, as the case may be.

10. The ordinary rates charged for carriage do not in any case include delivery *to*, or collection *from*, the Show ground.

11. Agricultural Societies' Show Plant must be charged at Class C rates, station to station.

12. Tents, Canvas, and other articles carried to Shows, not for exhibition, to be charged the ordinary rates both going and returning.

13. The carriage of all Live Stock, Implements, and other articles going to the Show for exhibition must be *prepaid.*

## DELIVERY CHARGES.

The following will be the Charges for the Delivery or Collection of Live Stock, Implements, and other articles between the Railway Stations at Scotstoun and the Show ground :—

1. General traffic, 1s. 6d. per ton (minimum charge, 1s.)
2. Implements and Machinery (Agricultural), not exceeding 1 ton each, 2s. per ton (minimum charge, 1s. 6d )
3. Implements and Machinery (Agricultural), on their own wheels (specially hauled), not exceeding 1 ton, 2s. each.
4. Single articles, exceeding 1 ton but not exceeding 3 tons, 2s. 6d. per ton.
5. Single articles, exceeding 3 tons but not exceeding 5 tons, 3s. 6d. per ton.
6. Single articles, exceeding 5 tons, by special arrangement only, but no less charge than 5s. per ton.
7. Rustic Houses, by special arrangement only, but no less charge than 6s. each load.
8. Carriages, four-wheeled, 2s. 6d. each.
9. Carriages, two-wheeled, 2s. each.
10. Cattle, in floats, 2s. per head, minimum charge, 3s.
11. Sheep and Pigs, in floats, 1s. per head (minimum charge, 3s., and maximum charge, 5s. for each float).

# THE PRESIDENT'S CHAMPION MEDALS

A Champion Medal is given by THE EARL OF EGLINTON AND WINTON, President of the Society, for the *best Animal or pen* in each of the following sections :—

1. Shorthorn.
2. Aberdeen-Angus.
3. Galloway.
4. Highland.
5. Ayrshire.
6. Clydesdale Stallions.
7. Draught Geldings.
8. Clydesdale Mares and Fillies.
9. Gelding in Harness.
10. Hunters.
11. Hackneys.
12. Ponies.
13. Polo and Riding Ponies.
14. Best Pony in Class 71.
15. Highland Ponies.
16. Shetland Ponies.
17. Harness Horses.
18. Van Horses.
19. Blackfaced Sheep.
20. Cheviot.
21. Border Leicester.
22. Half-bred.
23. Shropshire.
24. Oxford Down.
25. Suffolk.
26. Swine.

NOTE.—*Animals entered as Extra Stock may compete for these Medals. Former Winners of the President's Medals are eligible. The Society shall have the right to photograph the Winners for publication in the 'Transactions.' At this Show no animal can be awarded more than one of these Medals.*

# CATTLE

## SHORTHORN.

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | 4th. £ | |
|---|---|---|---|---|---|---|
| | Tweeddale Gold Medal for best Shorthorn Bull. | | | | | |
| 1. | Bull calved before 1903 | 15 | 10 | 5 | 3 | |
| 2. | Bull calved in 1903 | 15 | 10 | 5 | 3 | |
| 3. | Bull calved in 1904 | 12 | 8 | 4 | 2 | |
| | [1] Best Shorthorn Bull in the Show, entered or eligible for entry in Coates's Herd-Book—£25. | | | | | |
| | Breeder of best Bull of any age in the three Classes—The Silver Medal. | | | | | |
| 4. | Cow of any age in Milk | 12 | 8 | 4 | 2 | |
| 5. | Heifer calved in 1903 | 10 | 5 | 3 | 2 | |
| 6. | Heifer calved in 1904 | 10 | 5 | 3 | 2 | |
| | [1] Best Shorthorn Female in the Show, entered or eligible for entry in Coates's Herd-Book—£25. | | | | | |
| | *President's Medal for best Shorthorn.* | | | | | £158 |

## ABERDEEN-ANGUS.

[2] Two Silver Cups, each of the value of £50, for the best Bull of any age and for the best Cow of any age (Heifers excluded) in the Aberdeen-Angus cattle classes. These are to be Challenge Cups, and are to be known as the "Ballindalloch Challenge Cups." They are offered under the following conditions: 1. The Directors shall assume charge of the Cups, and shall frame such rules for their safety as they may decide upon. 2. Each Cup shall be held by the winner for one year as a Challenge Cup, and shall become the property of the exhibitor who shall win it five times, not necessarily in succession. 3. The Society shall, at their own expense, cause to be engraved on each Cup each year, the year, the place of the Show, name of successful exhibitor, name and herd-book number of the animal, and name of its breeder. 4. The Society shall award to the breeder of the successful animals a Silver Medal, bearing that he is the breeder of the winner of the "Ballindalloch Challenge Cup." 5. In every other respect the Cups shall be won according to regulations which the Directors may from time to time enact.

| | | | | | | |
|---|---|---|---|---|---|---|
| 7. | Bull calved before 1st Dec. 1902 | 15 | 10 | 5 | 3 | |
| 8. | Bull calved on or after 1st Dec. 1902 | 15 | 10 | 5 | 3 | |
| 9. | Bull calved on or after 1st Dec. 1903 | 12 | 8 | 4 | 2 | |
| | [2] Champion Cup, value £50, for the best Bull in the three Classes. | | | | | |
| | Breeder of best Bull of any age in the three Classes—The Silver Medal. | | | | | 92 |
| | | | | | Carry forward | £250 |

[1] Given by the Shorthorn Society.
[2] The Cup for Bulls given by Sir George Macpherson Grant, Bart., and that for Cows by the late Mr C. Macpherson Grant of Drumduan.

| | | | | | |
|---|---|---|---|---|---|
| | **Brought forward** ... ... | | | | £250 |
| | Premiums. | | | | |
| ABERDEEN-ANGUS—*continued.* | 1st. | 2nd. | 3rd. | 4th. | |
| Class | £ | £ | £ | £ | |
| 10. Cow of any age in Milk . . | 12 | 8 | 4 | 2 | |
| [1] Champion Cup, value £50, for the best Cow of any age in the above Class. | | | | | |
| 11. Heifer calved on or after 1st Dec. 1902 | 10 | 5 | 3 | 2 | |
| 12. Heifer calved on or after 1st Dec. 1903 | 10 | 5 | 3 | 2 | |
| [2]Champion Gold Medal for best breeding animal of the breed in the Showyard. | | | | | |
| *President's Medal for best Aberdeen-Angus Animal.* | | | | | |
| | | | | | 66 |
| GALLOWAY. | | | | | |
| 13. Bull calved before 1st Dec. 1902 . | 15 | 10 | 5 | 3 | |
| 14. Bull calved on or after 1st Dec. 1902 . | 15 | 10 | 5 | 3 | |
| 15. Bull calved on or after 1st Dec. 1903 . | 12 | 8 | 4 | 2 | |
| Breeder of best Bull of any age in the three Classes--The Silver Medal. | | | | | |
| 16. Cow of any age in Milk . . | 12 | 8 | 4 | 2 | |
| 17. Heifer calved on or after 1st Dec. 1902 | 10 | 5 | 3 | 2 | |
| 18. Heifer calved on or after 1st Dec. 1903 | 10 | 5 | 3 | 2 | |
| *President's Medal for best Galloway.* | | | | | 158 |
| HIGHLAND. | | | | | |
| 19. Bull calved before 1903 . . | 15 | 10 | 5 | 3 | |
| 20. Bull calved in 1903 . . . | 15 | 10 | 5 | 3 | |
| 21. Bull calved in 1904 . . . | 12 | 8 | 4 | 2 | |
| Breeder of best Bull of any age in the three Classes—The Silver Medal. | | | | | |
| 22. Cow of any age in Milk . . | 12 | 8 | 4 | 2 | |
| 23. Heifer calved in 1902 . . | 10 | 5 | 3 | 2 | |
| 24. Heifer calved in 1903 . . | 10 | 5 | 3 | 2 | |
| *President's Medal for best Highland Animal.* | | | | | |
| | | | | | 158 |
| AYRSHIRE. | | | | | |
| 25. Bull calved before 1903 . . | 12 | 8 | | | |
| 26. Bull calved in 1903 . . . | 10 | 7 | | | |
| 27. Bull calved in 1904 . . . | 8 | 5 | | | |
| [3] Champion Prize of £10 for best Ayrshire Bull in the Showyard, entered with a number in the Ayrshire Cattle Herd-Book. | | | | | |
| Breeder of best Bull of any age in the three Classes—The Silver Medal. | | | | | 60 |
| | **Carry forward** | | | | £692 |

[1] The Cup for Bulls given by Sir George Macpherson Grant, Bart., and that for Cows by the late Mr C. Macpherson Grant of Drumduan.
[2] Given by the Polled Cattle Society.
[3] Given by the Ayrshire Cattle Herd-Book Society.

Brought forward ... ... £692

AYRSHIRE—*continued.*

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | |
|---|---|---|---|---|---|
| 28. | Cow calved before 1902 in Milk . | 12 | 8 | 4 | |
| 29. | Cow in Milk, calved after 1st Jan. 1902 | 10 | 7 | 3 | |
| 30. | Cow of any age in Calf, or Heifer calved in 1902 in Calf and due to calve within nine months after the Show . . . . | 10 | 7 | 3 | |
| 31. | Heifer calved in 1903 . . . | 10 | 5 | 3 | |
| 32. | Heifer calved in 1904 . . . | 8 | 5 | 3 | |
| | [1] Champion Prize of £10 for best Ayrshire Female in the Showyard, entered with a number in the Ayrshire Cattle Herd-Book. | | | | |
| | *President's Medal for best Ayrshire.* | | | | 98 |
| | | | | | £790 |

# HORSES

FOR AGRICULTURAL PURPOSES.

DRAUGHT STALLIONS.

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | 4th. £ | |
|---|---|---|---|---|---|---|
| 33. | Stallion foaled before 1902 . . | 20 | 15 | 10 | 4 | |
| 34. | Entire Colt foaled in 1902 . . | 20 | 15 | 10 | 4 | |
| 35. | Entire Colt foaled in 1903 . . | 20 | 12 | 8 | 4 | |
| 36. | Entire Colt foaled in 1904 . . | 15 | 10 | 6 | 4 | |
| | Breeder of best Male Animal of any age in the four Classes—The Silver Medal. | | | | | £177 |

*President's Medal for best Clydesdale Stallion or Colt.*

DRAUGHT GELDINGS.

| | | | | | | |
|---|---|---|---|---|---|---|
| 37. | Draught Gelding foaled before 1902 | 10 | 5 | 3 | — | |
| 38. | Draught Gelding foaled in 1902 . | 6 | 4 | 3 | — | |
| 39. | Draught Gelding foaled in 1903 . | 6 | 4 | 3 | — | |
| | | | | | | 44 |

*President's Medal for best Draught Gelding.*

Carry forward £221

**No animal is allowed to compete in more than one Class, except that horses entered in other Classes may also compete in the Jumping and Driving Classes.**

[1] Given by the Ayrshire Cattle Herd-Book Society.

Brought forward ... ... £221

DRAUGHT MARES AND FILLIES.

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | 4th. £ | |
|---|---|---|---|---|---|---|
| 40. | Mare of any age, with Foal at foot | 20 | 12 | 7 | 4 | |
| 41. | Yeld Mare foaled before 1902 . | 12 | 9 | 6 | 4 | |
| 42. | Yeld Mare or Filly foaled in 1902 . | 12 | 9 | 6 | 4 | |
| 43. | Filly foaled in 1903 . . | 12 | 9 | 6 | 4 | |
| 44. | Filly foaled in 1904 . . | 12 | 9 | 6 | 4 | |
| | | | | | | 167 |

Best Clydesdale Mare or Filly—Cawdor Challenge Cup, value 50 guineas. See Conditions below.

CONDITIONS OF COMPETITION FOR THE CAWDOR CHALLENGE CUP. (VALUE 50 GUINEAS)

1. This Cup is offered by the Clydesdale Horse Society of Great Britain and Ireland for the best Clydesdale Stallion or Colt, and Mare or Filly registered in the Clydesdale Stud-Book, entered in any of the Draught Horse classes, at the Show at which they may be competed for.

2. The Council of the Clydesdale Horse Society shall, at a meeting held not later than the month of August in any year, decide at what Show or Shows the "Cawdor Challenge Cups" shall be competed for in the year immediately following.

3. The Cup must be won three times by an Exhibitor with different animals (but not necessarily in consecutive years) before it becomes his absolute property; and immediately after an award has been made, and official notification thereof has been received by the Secretary of the Clydesdale Horse Society from the Secretary of the Society under whose auspices the Competition has taken place, the name of the winner, and of the animal with which the Cup has been won, will be engraven on the Cup.

4. The winner of the Cawdor Challenge Cup, other than the absolute winner, shall, before delivery thereof is made to him, give security to the Clydesdale Horse Society that he shall surrender the same to the Society and deliver it at the Society's office when called upon to do so.

5. Until the Cup be won outright, the winner of each of the Cawdor Challenge Cups will receive the Clydesdale Horse Society's Silver Medal as a memento of his winning the Cup; and the said Medal shall bear an inscription specifying the Show at which, the date on which, and the name of the animal with which the Challenge Cup has been won, as well as the name of the owner.

In name of the Council of the Clydesdale Horse Society,

ARCHD. MACNEILAGE, *Secretary.*

[1] Breeder of Best Clydesdale Brood Mare—The Robert Murdoch Prize, value £10.

*President's Medal for best Clydesdale Mare or Filly.*

Carry forward £388

[1] Bequest by the late Miss Murdoch.

Brought forward ... ... £388

Class DRAUGHT GELDINGS IN HARNESS.

45. Draught Geldings, any age, in Harness, it being a condition that the horses must have been regularly worked on the streets of Glasgow for a period of twelve weeks prior to the first day of the Show—the horses to be exhibited on Thursday, 6th July only, the prize-winners to take part, if required, in both parades on Thursday and Friday—Prizes [1]—£5, £3, £2.

*President's Medal for best Gelding in Harness.*

HUNTERS.

| | Premiums. 1st. £ | 2nd. £ | 3d. £ | 4th. £ | |
|---|---|---|---|---|---|
| 46. Colt, Gelding, or Filly, foaled in 1904, the produce of thoroughbred Stallions, out of Mares of any breed,—Five Prizes [2]—£10, £7, £5, £2, £1. | | | | | |
| 47. Filly, Mare, or Gelding, for field, foaled in 1903—*in hand* . | 8 | 5 | 3 | — | |
| 48. Yeld Mare, Filly, or Gelding, for field, foaled in 1902—*in hand* . | 8 | 5 | 3 | — | |
| [3]Best Hunter Filly in Classes 49, 50, and 51, registered or entered in the Hunter Stud-Book — Gold Medal, value £10, 10s. | | | | | |
| 49. [4]Four-year-old Hunters, to carry over 13 stone 7 lb. . . . | 20 | 10 | 5 | — | |
| 50. Four-year-old Hunters, to carry 12 stone to 13 stone 7 lb. . . | 20 | 10 | 5 | — | |
| 51. Aged Hunters, to carry over 15 stone | 25 | 15 | 7 | — | |
| 52. Aged Hunters, to carry 13 stone 7 lb. to 15 stone . . . | 50 | 30 | 20 | 10 | |
| 53. Aged Hunters, to carry 12 stone to 13 stone 7 lb. . . . | 25 | 15 | 7 | — | |
| [5]For Hunters, four-year-old and upwards, exhibited in the Hunter Classes, owned by tenant farmers whose chief occupation is farming, and hunted by them with any established pack of fox-hounds in Scotland in the season 1904-5 * . | 15 | 10 | 5 | — | |
| | | | | | 336 |

Carry forward £724

[1] Given by Mr W. Clark, Netherlea.
[2] Given by Sir John Gilmour of Montrave, Bart.
[3] Given by the Hunter Improvement Society.
[4] Towards prizes for made Hunters a sum of £200 was contributed per Mr Alex. Cross of Knockdon.
[5] If the entries exceed twenty they may be formed into two classes, with £60 in prizes.

* A certificate must be furnished from the Master of the Pack to the effect that the animal has been hunted as provided.

**Brought forward ... ... £724**

| HUNTERS—*continued.* | Premiums. 1st. | 2nd. | 3rd. | |
|---|---|---|---|---|
| Class | £ | £ | £ | |
| For Hunters, four-year-old and upwards, exhibited in the Hunter Classes, the property of members of any established pack of fox-hounds in Scotland, and hunted by them during season 1904-5, to carry 13 to 15 stone*. | 12 | 8 | 4 | |
| For Hunters exhibited in the Hunter Classes, the property of ladies, and hunted by them with any established pack of fox-hounds in Scotland during season 1904-5, to carry 12 to 13 stone*. | 12 | 8 | 4 | |
| 54. [1]Hunter Brood Mare, with foal at foot or to foal this season—£20, £10, £5. | | | | 48 |

*President's Medal for best Hunter.*

HACKNEYS.

*(All to be shown in hand.)*

| | | | | |
|---|---|---|---|---|
| 55. Brood Mare, 15 hands and upwards, with Foal at foot, or to foal this season to a registered Sire | 10 | 6 | 4 | |
| 56. Brood Mare, under 15 hands, with Foal at foot, or to foal this season to a registered Sire | 10 | 6 | 4 | |
| 57. Yeld Mare or Filly, foaled in 1902 | 8 | 5 | 3 | |
| 58. Filly, foaled in 1903 | 8 | 5 | 3 | |
| 59. Filly, foaled in 1904 | 8 | 5 | 3 | |
| 60. Stallion, foaled in or before 1902, over 15 hands | 10 | 6 | 4 | |
| 61. Stallion, foaled in or before 1902, over 14 and not over 15 hands | 10 | 6 | 4 | |
| 62. Entire Colt, foaled in 1903 | 8 | 5 | 3 | |
| 63. Entire Colt, foaled in 1904 | 8 | 5 | 3 | |
| | | | | 160 |

All animals entered in the above Hackney Classes must be registered in the Hackney Stud-Book except in Classes 59 and 63, and animals entered in Classes 59 and 63 must be eligible for entry in the Hackney Stud-Book.

**Carry forward £932**

[1] Given by Captain Clayhills Henderson of Invergowrie, R.N.

* A certificate must be furnished from the Master of the Pack to the effect that the animal has been hunted as provided.

Brought forward ... ... £1042

| Class | SHETLAND PONIES. (*All to be shown in hand.*) | Premiums. 1st. | 2nd. | 3rd. | |
|---|---|---|---|---|---|
| | | £ | £ | £ | |
| 75. | Stallion, not exceeding 10½ hands, foaled before 1902 . . | 5 | 3 | 2 | |
| 76. | Entire Colt, not exceeding 10½ hands, foaled in 1902 or 1903 . . | 5 | 3 | 2 | |
| 77. | Mare, not exceeding 10½ hands, with foal at foot . . . | 5 | 3 | 2 | |
| 78. | Yeld Mare, not exceeding 10½ hands | 5 | 3 | 2 | |
| 79. | Filly, not exceeding 10½ hands, foaled in 1902 or 1903 . | 5 | 3 | 2 | |
| | | | | | 50 |

[1] Best Group of Shetland Ponies, consisting of a Male and three Females, exhibited in the Ordinary Classes—Model in Bronze of a Shetland Pony, executed from life, by Mr Robert Alexander, R.S.A.

*President's Medal for best Shetland Pony.*

| | DRIVING COMPETITIONS.[2] | | | | |
|---|---|---|---|---|---|
| 80. | Stallion, Mare, Filly, or Gelding, over 15.1 hands . . . | 20 | 10 | 5 | |
| 81. | Stallion, Mare, Filly, or Gelding, over 14 and not exceeding 15.1 hands. | 20 | 10 | 5 | |
| 82. | Stallion, Mare, Filly, or Gelding, 14 hands and under . . . | 15 | 10 | 5 | |
| 83. | [3] Pair Mares, Fillies, or Geldings in double Harness, over 15.1 hands . | 20 | 10 | 5 | |
| 84. | [3] Pair Mares, Fillies, or Geldings in double Harness, 15.1 hands and under . . . . | 20 | 10 | 5 | |
| 85. | [3] Pair Mares, Fillies, or Geldings driven Tandem, any height . | 20 | 10 | 0 | |
| | [2] Champion Prize of Twenty Guineas for best Horse in the Driving Classes, shown in competition for this prize, in single Harness . | 21 | — | — | |
| | | | | | 221 |

[4] *President's Medal for best animal in the Classes for Horses in Harness.*

| | VAN HORSES. | | | | |
|---|---|---|---|---|---|
| 86. | [5] Mare or Gelding, 3 years old and upwards, suited for heavy van purposes, shown in trade van, to be exhibited on Thursday, 6th July only, the winners to take part, if required, in both parades on Thursday and Friday . . . | 10 | 6 | 4 | |
| | | | | | 20 |

*President's Medal for best Van Horse.*

£1333

[1] Given by Mr Charles Douglas, M.P.

[2] £81 contributed towards these prizes by private subscribers.

[3] Animals shown in pairs may be drawn from other Classes, or entered specially; animals driven tandem cannot also be shown in double harness.

[4] *An animal that has won a President's Medal in another section in this Show shall not be eligible to compete for the Medal in this section.*

[5] £10 contributed towards these prizes, per Mr W. Taylor, Park Mains.

# JUMPING COMPETITIONS

## SPECIAL REGULATIONS.

*(See also the Regulations on pages* 57 *to* 64.)

1. Jumping Competitions will take place on the afternoons of Wednesday, Thursday, and Friday, the 5th, 6th, and 7th July.
2. *Entries* for each day's Competitions will close at the Secretary's Office in the Showyard at 6 P.M. on the preceding day.
3. *Entry Fees.*—Wednesday, £1; Thursday and Friday, 10s. for each class; Evening Jumping, Free.
4. *Accommodation* for jumping horses will be provided as follows: Covered shed in which to stand during the day free of charge; or, on application to the Secretary not less than ten days before the opening of the Show, stalls or loose-boxes will be provided at a charge (in addition to the Entry Fee) of £1 for a stall, and £1, 10s. for a loose-box, which must be paid along with the Entry Fee at the time of application.
5. Horses entered for jumping only need not enter the Showyard till 12 noon on the day of Competition, and may leave the Showyard at 6 P.M. each day.
6. *The Jumps* may consist of Single Hurdle, Gate, Double Hurdle, Wall, and Water Jump, power being reserved by the Society to alter these, as well as the Handicaps, as may be thought desirable.

| Class | 1st. £ | 2nd. £ | 3rd. £ | 4th. £ | 5th. £ |
|---|---|---|---|---|---|
| **WEDNESDAY.** | | | | | |
| 1. Horse or Pony any height | 20 | 15 | 10 | 5 | 3 |
| **THURSDAY.** | | | | | |
| 2. Horse or Pony any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in Class 1 | 10 | 8 | 5 | 3 | 2 |
| **FRIDAY.** | | | | | |
| 3. Horse or Pony any height, Handicap, hurdles and gate being raised 8 inches for the winner of the first prize, and 4 inches for the winner of the second prize in either of Classes 1 or 2—4 inches extra for the winner of the two first prizes in Classes 1 and 2 | 10 | 8 | 5 | 3 | 2 |
| Champion Prize for most points in Prizes with one or more horses in above Classes—First Prize to count five points; Second Prize, four points; Third Prize, three points; Fourth Prize, two points; and Fifth Prize, one point—the money to be evenly divided in the event of a tie | 10 | — | — | — | — |
| **WEDNESDAY AND THURSDAY EVENINGS.** | | | | | |
| Horse or Pony any height (each evening) | 10 | 5 | 3 | 2 | — |

£159

# SHEEP

BLACKFACED.

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | 4th. £ | |
|---|---|---|---|---|---|---|
| 87. | Tup above one shear . . | 12 | 8 | 4 | 2 | |
| 88. | Shearling Tup . . . | 12 | 8 | 4 | 2 | |
| 89. | Ewe above one shear, with her Lamb at foot . . . | 10 | 5 | 2 | — | |
| 90. | Shearling Ewe or Gimmer . . | 10 | 5 | 2 | — | |
| 91. | Ram Lamb drawn from Class 89, or entered here along with dam (the dam, which may be clipped or unclipped, will not be judged)—Prizes [1]—£4, £2, £1. | | | | | |
| | Blackface Shearling Ram in Class 87 best fitted for producing stock to yield early maturity mutton and carrying the fleece best adapted for protecting the animal in a high, exposed, and stormy district,—Prizes [1]—£4, £2, £1. | | | | | £86 |

[2] A Challenge Trophy, value 100 guineas, for a Group of Sheep consisting of one aged ram, one shearling ram, one ewe and lamb, the lamb to be the produce of the ewe exhibited, and may be either a tup or ewe lamb, and to be judged as part of the group, and one gimmer, all to be bred by and the property of the exhibitor, or bred on the farm now in his possession and the property of exhibitor, and shown in the ordinary classes; the Trophy to become the property of the exhibitor winning it three times with different sheep; lambs, shearling rams, and gimmers being eligible to compete again. The donor will present a Silver Medal, duly inscribed, commemorative of the event, to the winner on each occasion.

*President's Medal for best pen of Blackface Sheep.*

CHEVIOT.

| | | | | | | |
|---|---|---|---|---|---|---|
| 92. | Tup above one shear . . | 12 | 8 | 4 | 2 | |
| 93. | Shearling Tup . . . | 12 | 8 | 4 | 2 | |
| 94. | Ewe above one shear, with her Lamb at foot . . . | 10 | 5 | 2 | — | |
| 95. | Shearling Ewe or Gimmer . . | 10 | 5 | 2 | — | |
| | [3] Challenge Cup, value £25, for best Sheep in the Cheviot Classes, to become the property of the Exhibitor who wins it three times. | | | | | 86 |

*President's Medal for best pen of Cheviot Sheep.*

Carry forward £172

[1] Given by Mr C. Howatson of Glenbuck.
[2] Given by Mr R. Sinclair Scott of Burnside.
[3] Given by the Cheviot Sheep Society.

| | | | | | |
|---|---|---|---|---|---|
| Brought forward ... ... | | | | | £172 |
| | Premiums. | | | | |
| BORDER LEICESTER. | 1st. | 2nd. | 3rd. | 4th. | |
| Class | £ | £ | £ | £ | |
| 96. Tup above one shear | 12 | 8 | 4 | 2 | |
| 97. Shearling Tup | 12 | 8 | 4 | 2 | |
| 98. Ewe above one shear | 10 | 5 | 2 | — | |
| 99. Shearling Ewe or Gimmer | 10 | 5 | 2 | — | |
| [1] Prize of £10 for best pen of Border Leicester Sheep, drawn from the Ordinary Classes, registered or eligible for registration in the Border Leicester Flock-Book. | | | | | 86 |
| *President's Medal for best pen of Border Leicesters.* | | | | | |
| HALF-BRED. | | | | | |
| 100. Tup above one shear | 12 | 8 | 4 | 2 | |
| 101. Shearling Tup | 12 | 8 | 4 | 2 | |
| 102. Ewe above one shear | 10 | 5 | 2 | — | |
| 103. Shearling Ewe or Gimmer | 10 | 5 | 2 | — | |
| *President's Medal for best pen of Half-Breds.* | | | | | 86 |
| SHROPSHIRE. | | | | | |
| 104. Tup above one shear | 6 | 4 | 2 | | |
| 105. Shearling Tup | 6 | 4 | 2 | | |
| 106. Ewe above one shear | 5 | 3 | 2 | | |
| 107. Shearling Ewe or Gimmer | 5 | 3 | 2 | | |
| *President's Medal for best pen of Shropshires.* | | | | | 44 |
| OXFORD-DOWNS. | | | | | |
| 108. Shearling Tup | 6 | 4 | 2 | | |
| 109. Shearling Ewe or Gimmer | 5 | 3 | 2 | | |
| *President's Medal for best pen of Oxford-Downs.* | | | | | 22 |
| SUFFOLK. | | | | | |
| 110. Shearling Tup | 6 | 4 | 2 | | |
| 111. Shearling Ewe or Gimmer | 5 | 3 | 2 | | |
| [2] Best Suffolk Ewe in Class 111 bred in Scotland—£3, £2. | | | | | |
| 112. [2] Three Ewe Lambs, uncoloured and untrimmed, except as to the squaring of the tail—£5, £3, and £2. | | | | | |
| [2] Best Pen of Suffolk Ewe Lambs in Class 112 bred in Scotland—£3, £2. | | | | | 22 |
| *President's Medal for best pen of Suffolk Sheep.* | | | | | |
| Carry forward | | | | | £432 |

[1] Given by the Society of Border Leicester Sheep Breeders.
[2] Given by the Suffolk Sheep Society.

| | | | | |
|---|---|---|---|---|
| Brought forward ... ... | | | | £432 |
| | Premiums. | | | |
| FAT SHEEP. | 1st. | 2nd. | 3rd. | |
| Class | £ | £ | £ | |
| 113. Five Fat Lambs, any breed or cross, dropped in the year of the Show | 5 | 3 | — | |
| | | | | £440 |

[1] Best pen of Lambs in Class 113 got by a Suffolk Tup, and out of Cheviot or Blackfaced Ewes—£5.

[1] Best pen of Lambs in Class 113 got by a Suffolk Tup, and out of Border Leicester, Half-bred, or Three-parts-bred Ewes—£5.

[2] Best pens of Cross-bred Lambs in Class 113 got by an Oxford-Down Tup—£5, £3, and £2.

## SWINE

| | | | | |
|---|---|---|---|---|
| | Premiums. | | | |
| LARGE WHITE BREED. | 1st. | 2nd. | 3rd. | |
| Class | £ | £ | £ | |
| 114. Boar . . . . . | 6 | 4 | 2 | |
| 115. Sow . . . . . | 6 | 4 | 2 | |
| 116. Three Pigs, not above 8 months old | 5 | 3 | 2 | |
| | | | | £34 |
| WHITE BREED OTHER THAN LARGE. | | | | |
| 117. Boar . . . . . | 6 | 4 | 2 | |
| 118. Sow . . . . . | 6 | 4 | 2 | |
| 119. Three Pigs, not above 8 months old | 5 | 3 | 2 | |
| | | | | 34 |
| BERKSHIRE. | | | | |
| 120. Boar . . . . . | 6 | 4 | 2 | |
| 121. Sow . . . . . | 6 | 4 | 2 | |
| 122. Three Pigs, not above 8 months old | 5 | 3 | 2 | |
| *President's Medal for best pen of Swine.* | | | | 34 |
| | | | | £102 |

## EXTRA STOCK

Animals not included in the Classes for Competition may be exhibited as Extra Stock, and may receive Awards as follows:—Very Highly Commended, or Highly Commended, carrying the Medium Silver Medal, or Commended, for which the Bronze Medal is given.

Animals entered as Extra Stock are eligible to compete for the President's Medals, whether former winners of these Medals or not.

[1] Given by the Suffolk Sheep Society.

[2] Given by Oxford-Down Sheep-Breeders' Association.

# POULTRY

*First Premium*—One Sovereign; *Second Premium*—Ten Shillings. In each Class in which there are six or more entries, a Third Prize of Five Shillings may be awarded, provided there is sufficient merit in the pens. Three or more Commendations may also be given—thus, Very Highly Commended, Highly Commended, and Commended.

*Champion Medals* are offered as follows:—

1. Best Cock, any Variety.
2. Best Hen, any Variety.
3. Best Cockerel, any Variety.
4. Best Pullet, any Variety.
5. Best Pen of Ducks.
6. Best Pen of Geese.
7. Best Pen of Turkeys.

Aged Birds must have been hatched previous to, and Cockerels and Pullets in, the year of the Show.

| | Class | |
|---|---|---|
| Dorking— *Coloured* | 1. | Cock |
| | 2. | Hen |
| | 3. | Cockerel |
| | 4. | Pullet |
| *Silver Grey* | 5. | Cock |
| | 6. | Hen |
| | 7. | Cockerel |
| | 8. | Pullet |
| Cochin-China | 9. | Cock |
| | 10. | Hen |
| Brahmapootra | 11. | Cock |
| | 12. | Hen |
| Brahma or Cochin | 13. | Cockerel |
| | 14. | Pullet |
| Scotch Grey | 15. | Cock |
| | 16 | Hen |
| | 17. | Cockerel |
| | 18. | Pullet |
| Hamburg— *Black* | 19. | Cock |
| | 20. | Hen |
| *Any other Variety* | 21. | Cock |
| | 22. | Hen |
| *Any Variety* | 23. | Cockerel |
| | 24. | Pullet |
| Plymouth Rock | 25. | Cock |
| | 26. | Hen |
| | 27. | Cockerel |
| | 28. | Pullet |
| Minorca | 29. | Cock |
| | 30. | Hen |
| | 31. | Cockerel |
| | 32. | Pullet |
| Leghorn— *White* | 33. | Cock |
| | 34. | Hen |
| *Any other Variety* | 35. | Cock |
| | 36. | Hen |
| *Any Variety* | 37. | Cockerel |
| | 38. | Pullet |
| Langshan | 39. | Cock |
| | 40. | Hen |
| Langshan | 41. | Cockerel |
| | 42. | Pullet |
| Orpington— *Black* | 43. | Cock |
| | 44. | Hen |
| *Buff* | 45. | Cock |
| | 46. | Hen |
| *Any Variety* | 47. | Cockerel |
| | 48. | Pullet |
| Wyandotte— *Gold* | 49. | Cock |
| | 50. | Hen |
| *Silver* | 51. | Cock |
| | 52. | Hen |
| *Any Variety* | 53. | Cockerel |
| | 54. | Pullet |
| Indian Game | 55. | Cock |
| | 56. | Hen |
| | 57. | Cockerel |
| | 58. | Pullet |
| Game— *Old English* | 59. | Cock |
| | 60. | Hen |
| *Modern* | 61. | Cock |
| | 62. | Hen |
| *Any Variety, not including Indian* | 63. | Cockerel |
| | 64. | Pullet |
| Bantam— *Game, any Variety, including Old English* | 65. | Cock |
| | 66. | Hen |
| *Any other Variety Bantam* | 67. | Cock |
| | 68. | Hen |
| Any other recognised Breed of Poultry | 69. | Cock |
| | 70. | Hen |
| | 71. | Cockerel |
| | 72. | Pullet |

| | Class |
|---|---|
| TABLE FOWLS— *Any Breed or Cross, to be judged solely as Table Fowls, and without regard to fancy points* | 73. Pair of Cockerels |
| | 74. Pair of Pullets |
| DUCKS— *Aylesbury* | 75. Drake |
| | 76. Duck |
| | 77. Drake (Young) |
| | 78 Duck (Young) |
| DUCKS— *Rouen* | 79. Drake |
| | 80. Duck |
| *Any other Variety* | 81. Drake |
| | 82. Duck |
| *Any Breed (Aylesbury excepted)* | 83. Drake (Young) |
| | 84. Duck (Young) |
| GEESE | 85. Gander |
| | 86. Goose |
| TURKEYS | 87. Cock |
| | 88. Hen |

Amount of Poultry Premiums, £154.

# DAIRY PRODUCE

No Exhibitor to show more than one lot in any Class.

| Class | | Premiums. 1st. £ | 2nd. £ | 3rd. £ | |
|---|---|---|---|---|---|
| 1. | Powdered Butter, not less than 7 lb. | 4 | 2 | 1 | |
| 2. | Fresh Butter, three 1-lb. rolls | 4 | 2 | 1 | |
| | | | | | £14 |
| 3. | Cheddar Cheese, 56 lb. and upwards—£12, £7, £4, £3, £2, £1 | | | | 29 |
| 4. | Flat White Cheese, made according to any method, from a dairy where all the cheese are made flat, 40 lb. and upwards—£5, £4, £3, £2 | | | | 14 |
| 5. | Cheese, 14 lb. and under—£4, £3, £2, £1 | | | | 10 |
| | | | | | £67 |

# IMPLEMENT TRIALS

## TRIAL OF POTATO DIGGERS

The Society will hold a Competitive Trial of Potato Diggers in the Glasgow Show District in the coming autumn on a date and at a place to be afterwards fixed.

The following Prizes are offered:—

For New Potato Diggers, or for Radical Improvements upon Old Potato Diggers—First Prize, £40; Second Prize, £10.

Entries close on Monday, 1st May 1905. Entries must be made on forms to be had from the Secretary.

## TRIAL OF POTATO DRESSERS

The Society will hold a Competitive Trial of Potato Dressers in the Glasgow Show District in the coming autumn on a date and at a place to be afterwards fixed.

The following Prizes are offered :—

For New Potato Dressers, or for Radical Improvements upon Old Potato Dressers—First Prize, £7 ; Second Prize, £3.

Entries close on Monday, 1st May 1905. Entries must be made on forms to be had from the Secretary.

## TRIAL OF TURNIP LIFTERS

The Society will hold a Competitive Trial of Turnip Lifters in the Glasgow Show District in the coming autumn on a date and at a place to be afterwards fixed.

The following Prizes are offered :—

For New Turnip Lifters, or for Radical Improvements upon Old Turnip Lifters—First Prize, £15 ; Second Prize, £5.

Entries close on Monday, 1st May 1905. Entries must be made on forms to be had from the Secretary.

## TRIAL OF GAS ENGINES

An Exhibition Trial will take place in the Showyard of Gas Engines worked from Suction Gas Producers, and suitable for agricultural operations.

Entries close on Monday, 1st May 1905. Entries must be made on forms to be had from the Secretary.

## EXHIBITION TRIAL OF SWATHE TURNERS

An Exhibition Trial of Swathe Turners will be held in connection with the Glasgow Show.

Entries close on Monday, 1st May 1905. Entries must be made on forms to be had from the Secretary.

## ABSTRACT OF PREMIUMS.

(26 Champion Medals given by THE EARL OF EGLINTON AND WINTON.)

### GIVEN BY THE SOCIETY.

| | | | | |
|---|---|---|---|---|
| 1. | Cattle | £790 | 0 | 0 |
| 2. | Horses | 1333 | 0 | 0 |
| 3. | Jumping | 159 | 0 | 0 |
| 4. | Sheep | 440 | 0 | 0 |
| 5. | Swine | 102 | 0 | 0 |
| 6. | Poultry | 154 | 0 | 0 |
| 7. | Dairy Produce | 67 | 0 | 0 |
| 8. | Medals to Breeders, &c. | 20 | 0 | 0 |
| 9. | Prizes for Timber [1] | 20 | 0 | 0 |
| 10. | Implement Trials | 80 | 0 | 0 |
| | | £3165 | 0 | 0 |
| | Private Subscriptions | 291 | 0 | 0 |
| | Given by the Society | £2874 | 0 | 0 |

### CONTRIBUTED PRIZES.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | The Shorthorn Society | £50 | 0 | 0 | | | |
| *2. | Sir George Macpherson Grant, Bart. | 50 | 0 | 0 | | | |
| *3. | The late Mr C. Macpherson Grant of Drumduan | 50 | 0 | 0 | | | |
| 4. | Polled Cattle Society | 10 | 0 | 0 | | | |
| 5. | Ayrshire Cattle Herd-Book Society | 20 | 0 | 0 | | | |
| *6. | Cawdor Challenge Cup | 52 | 10 | 0 | | | |
| 7. | Bequest by late Miss Murdoch | 10 | 0 | 0 | | | |
| 8. | Sir John Gilmour, Bart. | 25 | 0 | 0 | | | |
| 9. | Hunters' Improvement Society | 10 | 10 | 0 | | | |
| 10. | Captain Clayhills Henderson | 35 | 0 | 0 | | | |
| 11. | Prizes for Hunters, per Mr Alex. Cross | 200 | 0 | 0 | | | |
| 12. | Mr William Clark | 10 | 0 | 0 | | | |
| 13. | Hackney Horse Society | 10 | 0 | 0 | | | |
| 14. | Polo and Riding Pony Society | 10 | 10 | 0 | | | |
| 15. | Prizes for Driving Horses (contributed) | 81 | 0 | 0 | | | |
| 16. | Prizes for Van Horses, per Mr W. Taylor | 10 | 0 | 0 | | | |
| 17. | Mr Charles Howatson | 14 | 0 | 0 | | | |
| *18. | Mr R. Sinclair Scott | 105 | 0 | 0 | | | |
| 19. | Society of Border Leicester Sheep Breeders | 10 | 0 | 0 | | | |
| *20. | Cheviot Sheep Society | 25 | 0 | 0 | | | |
| 21. | Oxford-Down Sheep-Breeders' Association | 10 | 0 | 0 | | | |
| 22. | Suffolk Sheep Society | 30 | 0 | 0 | | | |
| | | | | | 828 | 10 | 0 |
| | | | | | £3702 | 10 | 0 |

[1] Grant to Royal Scottish Arboricultural Society for Prizes for Timber.
* Challenge Prizes.

JAMES MACDONALD, *Secretary.*

3 GEORGE IV. BRIDGE,
EDINBURGH, *February* 1905.

**The Society's Show for 1906 will be held at Peebles.**

# INDEX

PRINTED BY WILLIAM BLACKWOOD AND SONS.